

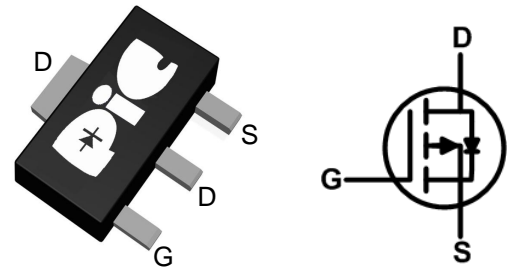
### ➤ General Description

This PAP31TK01K 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

- Super high density cell design for extremely
- low  $R_{DS(ON)}$
- SOT-89-3L package design

### ➤ SOT-89-3L



### ➤ Application

- Power Management in White LED System
- Push Pull Converter
- LCD TV Inverter & AD/DC Inverter Systems.

### ➤ Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
		Steady State	
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D@T_A=25^\circ C$	-4	A
Continuous Drain Current	$I_D@T_A=70^\circ C$	-3	A
Pulsed Drain Current	$I_{DM}$	$-20^2$	A
Total Power Dissipation	$P_D@T_A=25^\circ C$	$1.32^3$	W
Total Power Dissipation	$P_D@T_A=70^\circ C$	$0.84^3$	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 (Steady State) <sup>1</sup>	$R_{\theta JA}$	95	$^\circ C/W$
Thermal Resistance Junction-Case <sup>1</sup>	$R_{\theta JC}$	30	$^\circ C/W$

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-30	---	---	V
$BV_{DSS}$ Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^\circ C, I_D=-1mA$	---	-0.023	---	$V/^\circ C$
Static Drain-Source On-Resistance <sup>2</sup>	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-4A$	---	---	52	m $\Omega$
		$V_{GS}=-4.5V, I_D=-2A$	---	---	90	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.2	---	-2.5	V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}$		---	4	---	$mV/^\circ C$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=-24V, V_{GS}=0V, T_J=25^\circ C$	---	---	-1	$\mu A$
		$V_{DS}=-24V, V_{GS}=0V, T_J=55^\circ C$	---	---	-5	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
Forward Transconductance	$g_{fs}$	$V_{DS}=-5V, I_D=-4A$	---	11	---	S
Total Gate Charge (-4.5V)	$Q_g$	$V_{DS}=-15V, V_{GS}=-4.5V, I_D=-4A$	---	6.4	---	nC
Gate-Source Charge	$Q_{gs}$		---	2.3	---	
Gate-Drain Charge	$Q_{gd}$		---	1.9	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=-15V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-4A$	---	2.8	---	ns
Rise Time	$T_r$		---	8.4	---	
Turn-Off Delay Time	$T_{d(off)}$		---	39	---	
Fall Time	$T_f$		---	6	---	
Input Capacitance	$C_{iss}$	$V_{DS}=-15V, V_{GS}=0V, f=1MHz$	---	583	---	pF
Output Capacitance	$C_{oss}$		---	100	---	
Reverse Transfer Capacitance	$C_{rss}$		---	80	---	

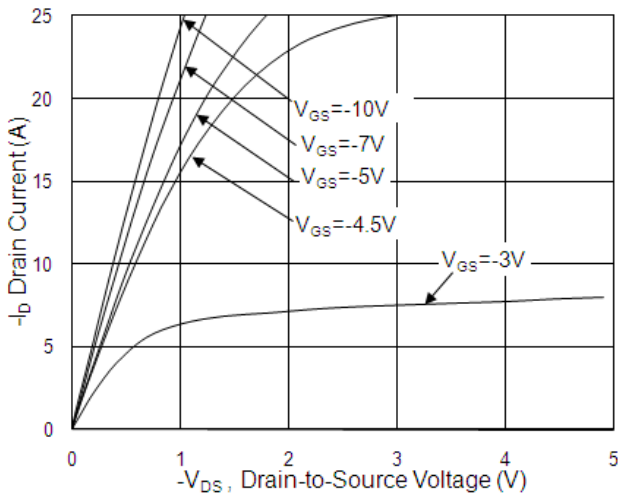
### ➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current <sup>1,4</sup>	$I_S$	$V_G=V_D=0V, \text{ Force Current}$	---	---	-4.5	A
Pulsed Source Current <sup>2,4</sup>	$I_{SM}$		---	---	-23	A
Diode Forward Voltage <sup>2</sup>	$V_{SD}$	$V_{GS}=0V, I_S=-1A, T_J=25^\circ C$	---	---	-1.2	V
Reverse Recovery Time	$t_{rr}$	$I_F=-4A, dI/dt=100A/\mu s, T_J=25^\circ C$	---	7.8	---	ns
Reverse Recovery Charge	$Q_{rr}$		---	2.5	---	nC

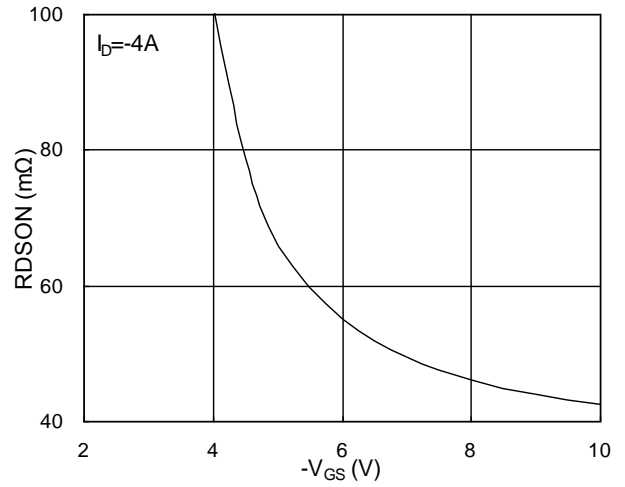
Note :

- 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.

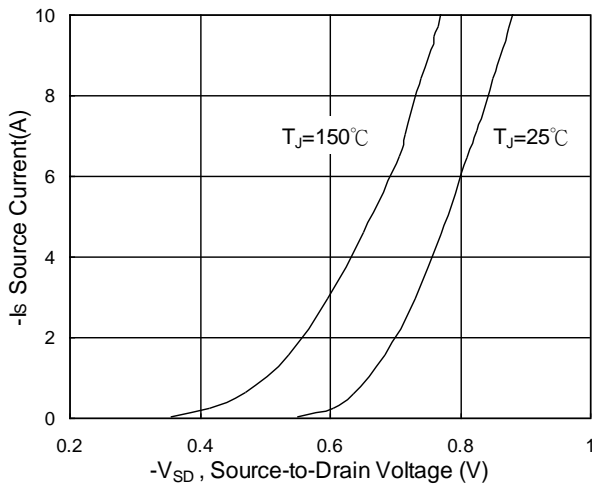
### ➤ Typical Characteristics



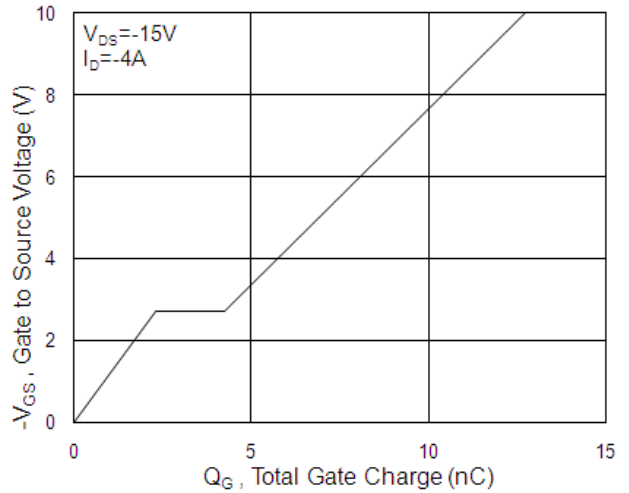
**Fig.1 Typical Output Characteristics**



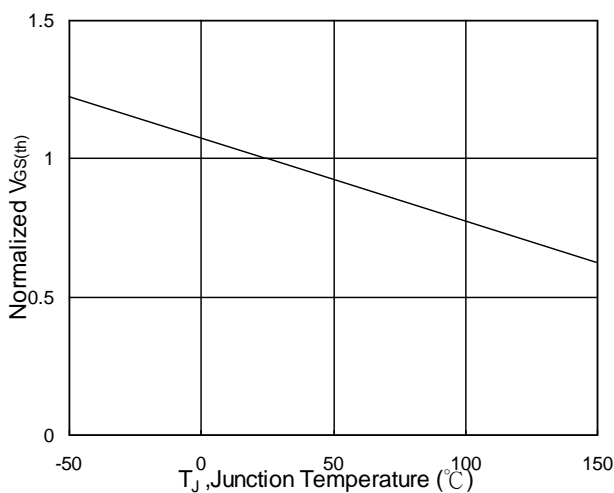
**Fig.2 On-Resistance vs. Gate-Source**



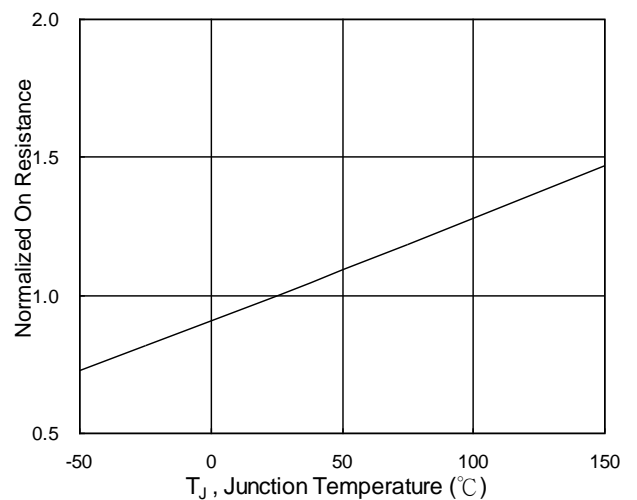
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**



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



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

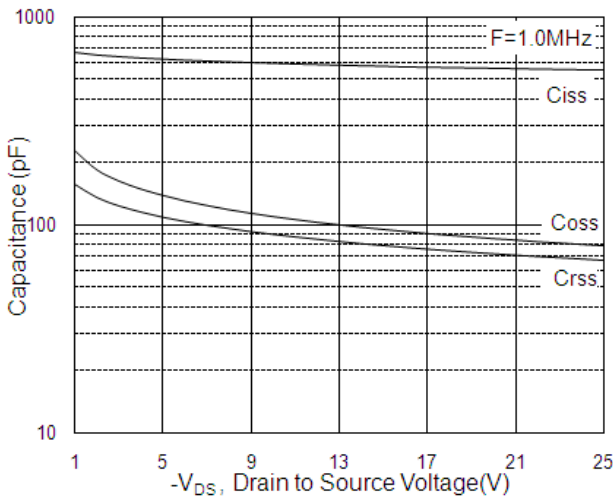


Fig.7 Capacitance

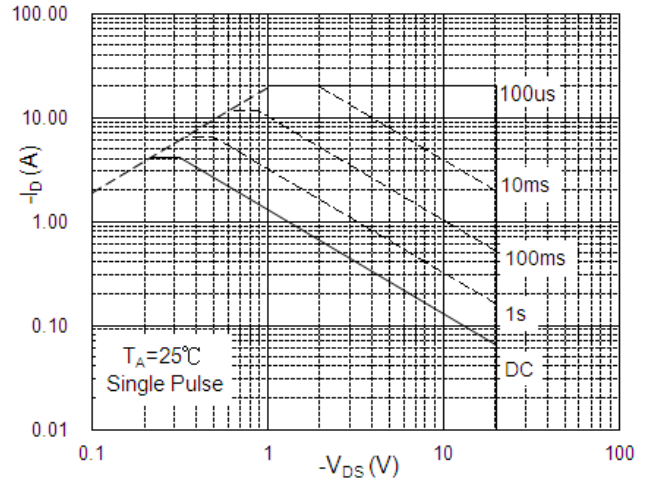


Fig.8 Safe Operating Area

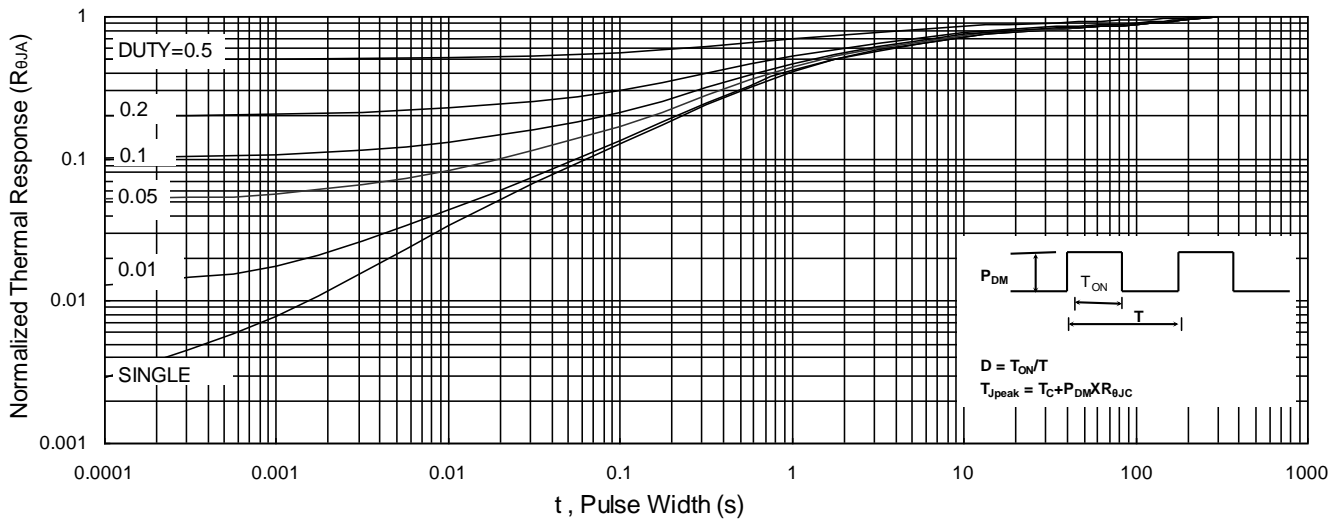


Fig.9 Normalized Maximum Transient Thermal Impedance

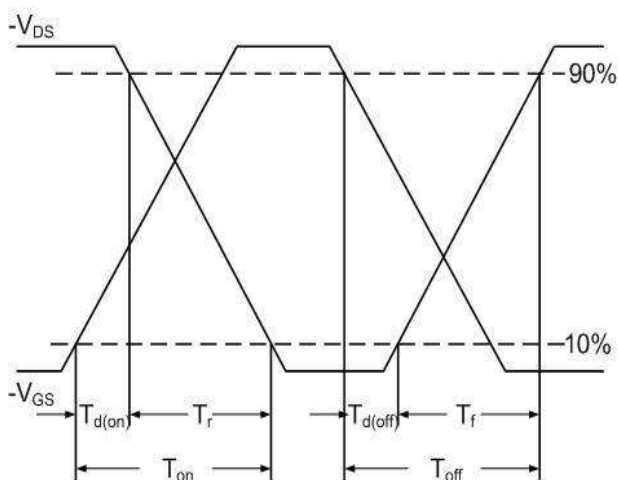


Fig.10 Switching Time Waveform

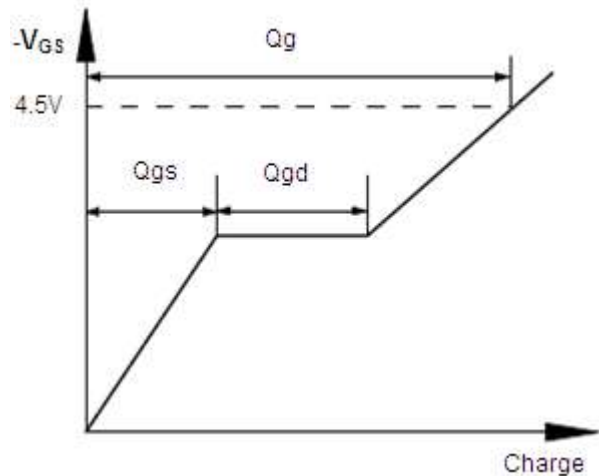


Fig.11 Gate Charge Waveform

➤ Recommend IR Reflow Soldering Thermal Profile

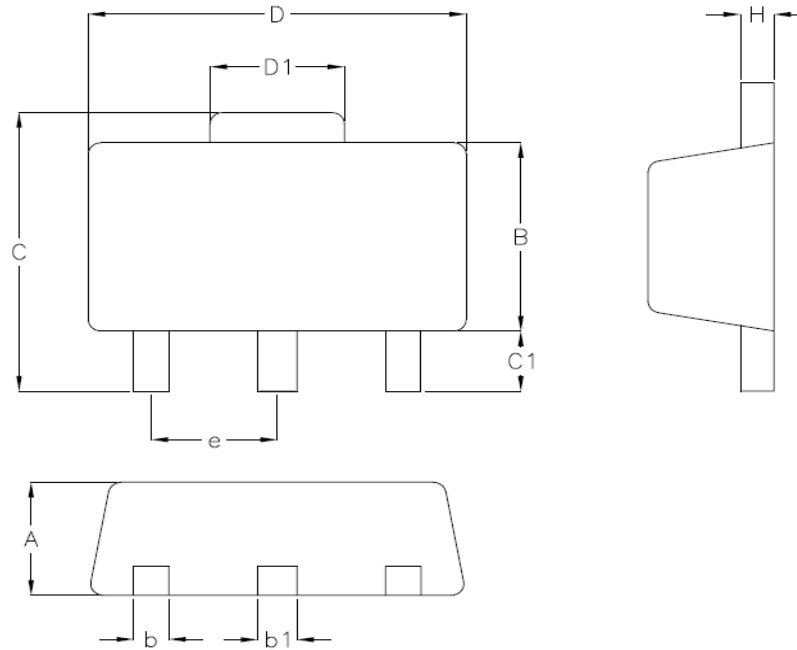


Profile Feature	Pb-Free Assembly Profile
Temperature Min. ( $T_{smin}$ )	150°C
Temperature Max. ( $T_{smax}$ )	200°C
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	60-120 seconds
Average Ramp-up Rate ( $t_L$ to $t_P$ )	3°C/second max.
Liquidous Temperature ( $T_L$ )	217°C
Time ( $t_L$ ) Maintained Above ( $T_L$ )	60 – 150 seconds
Peak Temperature	260°C +0°C / -5°C
Time ( $t_P$ ) within 5°C of actual Peak Temperature	30 seconds
Ramp-down Rate ( $T_P$ to $T_L$ )	6°C/second max
Time 25°C to Peak Temperature	8 minutes max.

➤ Ordering Information

Part Number	Description	Quantity
PAP31TK01K	SOT-89-3L Reel	1000 pcs

➤ Package Information (SOT-89-3L)



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.397	1.600	0.055	0.063
b	0.420	0.540	0.017	0.021
b1	0.420	0.540	0.017	0.021
B	2.388	2.591	0.094	0.102
C	3.937	4.242	0.155	0.167
C1	0.787	1.194	0.031	0.047
D	4.394	4.597	0.173	0.181
D1	1.397	1.753	0.055	0.069
e	1.448	1.549	0.057	0.061
H	0.350	0.44	0.014	0.017

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