

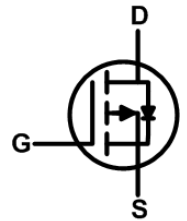
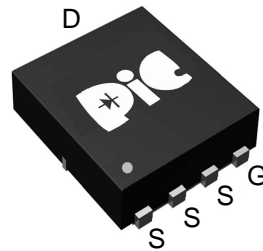
## ➤ General Description

This PAP31TY13Y 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 Low Gate Charge
- 100% EAS Guaranteed
- Green Device Available
- Excellent  $CdV/dt$  effect decline
- Advanced high cell density Trench technology

## ➤ DFN5X6A-EP1



## ➤ Application

- DC/DC Primary Side Switch
- Industrial Synchronous
- Rectification Load Switch
- DC/DC Converters

## ➤ Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current, $-V_{GS} @ -10V_1$	$I_D @ T_C = 25^\circ C$	-31	A
Continuous Drain Current, $-V_{GS} @ -10V_1$	$I_D @ T_C = 100^\circ C$	-24	A
Continuous Drain Current, $-V_{GS} @ -10V_1$	$I_D @ T_A = 25^\circ C$	-7	A
Pulsed Drain Current <sup>2</sup>	$I_{DM}$	-62	A
Single Pulse Avalanche Energy <sup>3</sup>	EAS	45	mJ
Avalanche Current	$I_{AS}$	-30	A
Total Power Dissipation <sup>4</sup>	$P_D @ T_C = 25^\circ C$	41.7	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>	$R_{\theta JA}$	62	$^\circ C/W$
Thermal Resistance Junction Case <sup>1</sup>	$R_{\theta JC}$	3	$^\circ C/W$

### ➤ 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 $25^\circ C, I_D = -1mA$	---	-0.021	---	V/ $^\circ C$
Static Drain-Source On-Resistance <sup>2</sup>	$R_{DS(ON)}$	$V_{GS} = -10V, I_D = -8A$	---	25	30	m $\Omega$
		$V_{GS} = -4.5V, I_D = -6A$	---	45	55	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}, I_D = -250\mu A$	-1.0	-1.5	-2.5	V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}$		---	-4.2	---	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	$g_{fs}$	$V_{DS} = -5V, I_D = -12A$	---	15	---	S
Gate Resistance	$R_g$	$V_{DS} = 0V, V_{GS} = 0V, f = 1MHz$	---	15	30	$\Omega$
Total Gate Charge (-4.5V)	$Q_g$	$V_{DS} = -20V, V_{GS} = -4.5V, I_D = -12A$	---	9.8	---	nC
Gate-Source Charge	$Q_{gs}$		---	2.2	---	
Gate-Drain Charge	$Q_{gd}$		---	3.4	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD} = -24V, V_{GS} = -10V, R_G = 3.3\Omega, I_D = -1A$	---	16.4	---	ns
Rise Time	$T_r$		---	20.2	---	
Turn-Off Delay Time	$T_{d(off)}$		---	55	---	
Fall Time	$T_f$		---	10	---	
Input Capacitance	$C_{iss}$	$V_{DS} = -15V, V_{GS} = 0V, f = 1MHz$	---	930	---	pF
Output Capacitance	$C_{oss}$		---	148	---	
Reverse Transfer Capacitance	$C_{rss}$		---	115	---	

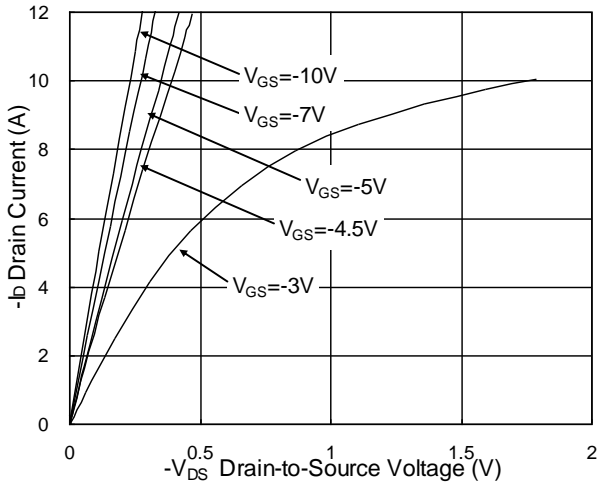
### ➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current <sup>1,5</sup>	$I_S$	$V_G = V_D = 0V, \text{ Force Current}$	---	---	-31	A
Pulsed Source Current <sup>2,5</sup>	$I_{SM}$		---	---	-62	A
Diode Forward Voltage <sup>2</sup>	$V_{SD}$	$V_{GS} = 0V, I_S = -1A, T_J = 25^\circ C$	---	---	-1.2	V

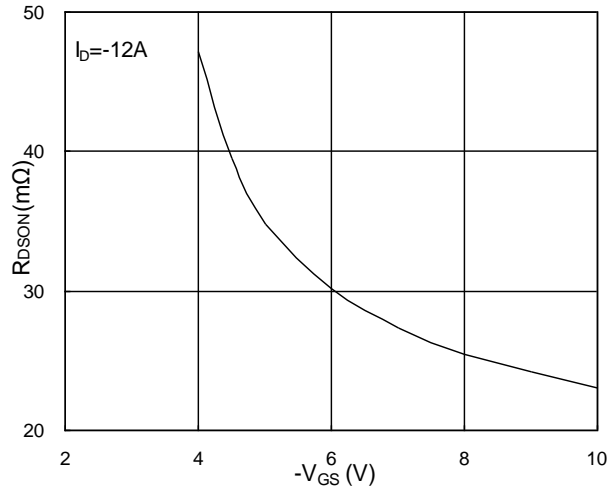
Note :

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. The EAS data shows Max. rating. The test condition is  $V_{DD} = -25V, V_{GS} = -10V, L = 0.1mH, I_{AS} = -30A$
4. Ensure that the channel temperature does not exceed  $150^\circ C$ .
5. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

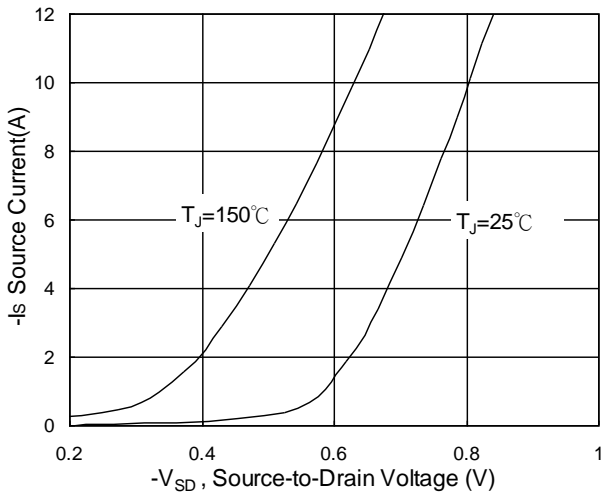
## ➤ Typical Characteristics



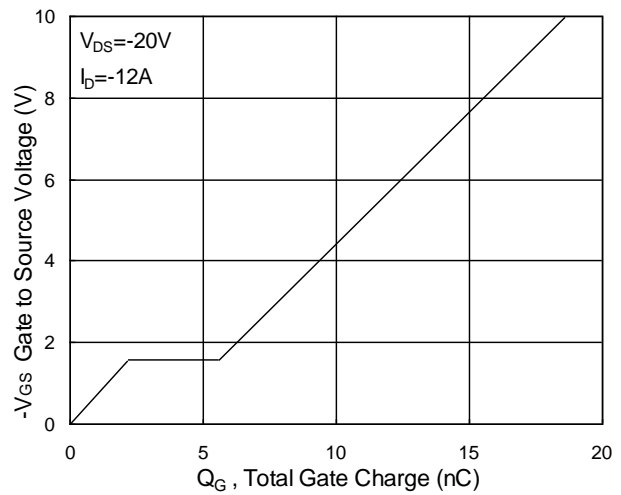
**Fig.1 Typical Output Characteristics**



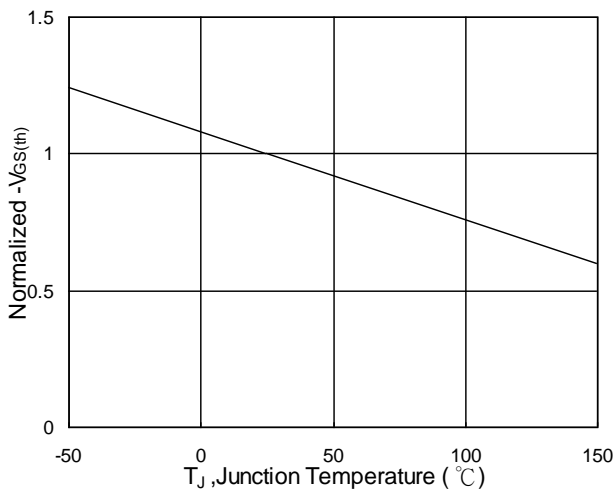
**Fig.2 On-Resistance v.s Gate-Source**



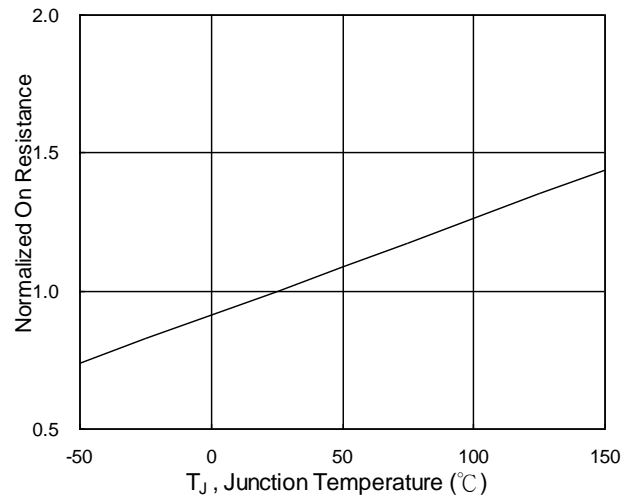
**Fig.3 Forward Characteristics of Reverse**



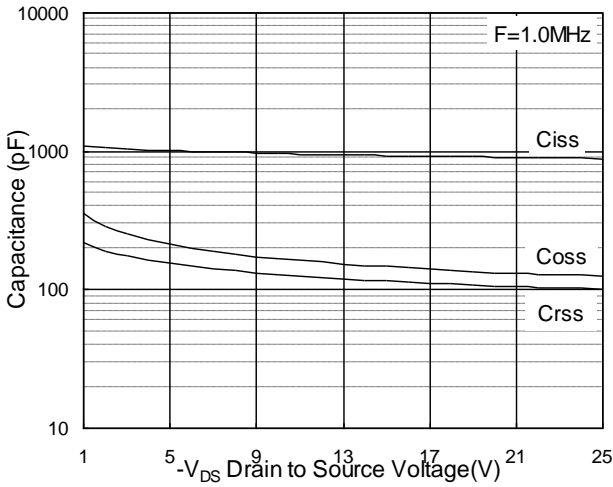
**Fig.4 Gate-Charge Characteristics**



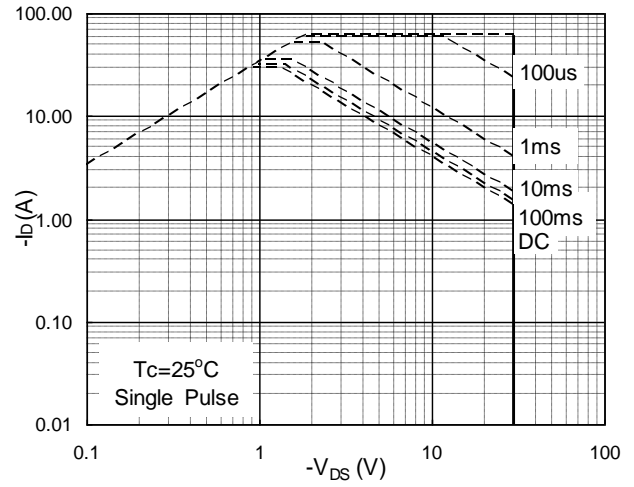
**Fig.5 Normalized  $V_{GS(th)}$  v.s  $T_J$**



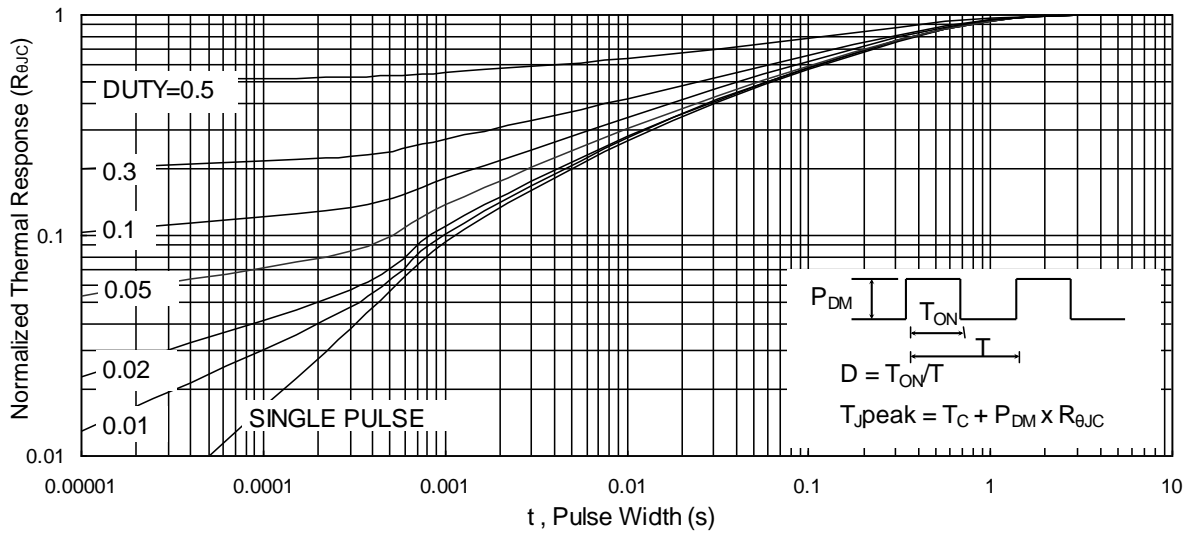
**Fig.6 Normalized  $R_{DS(on)}$  v.s  $T_J$**



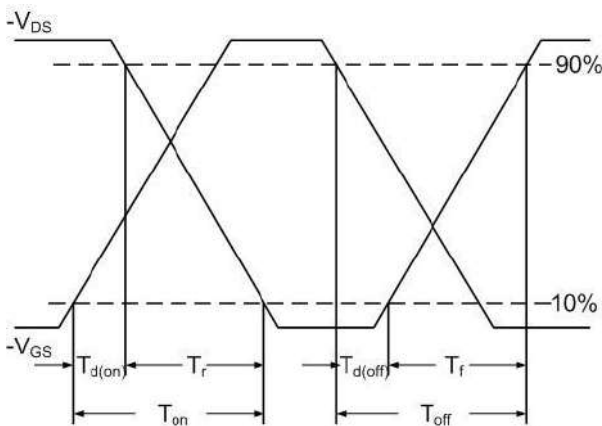
**Fig.7 Capacitance**



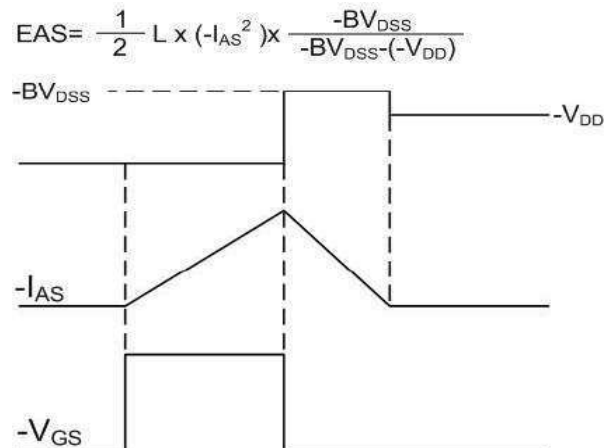
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Waveform**

## ➤ Recommand IR Reflow Soldering Thermal Profile

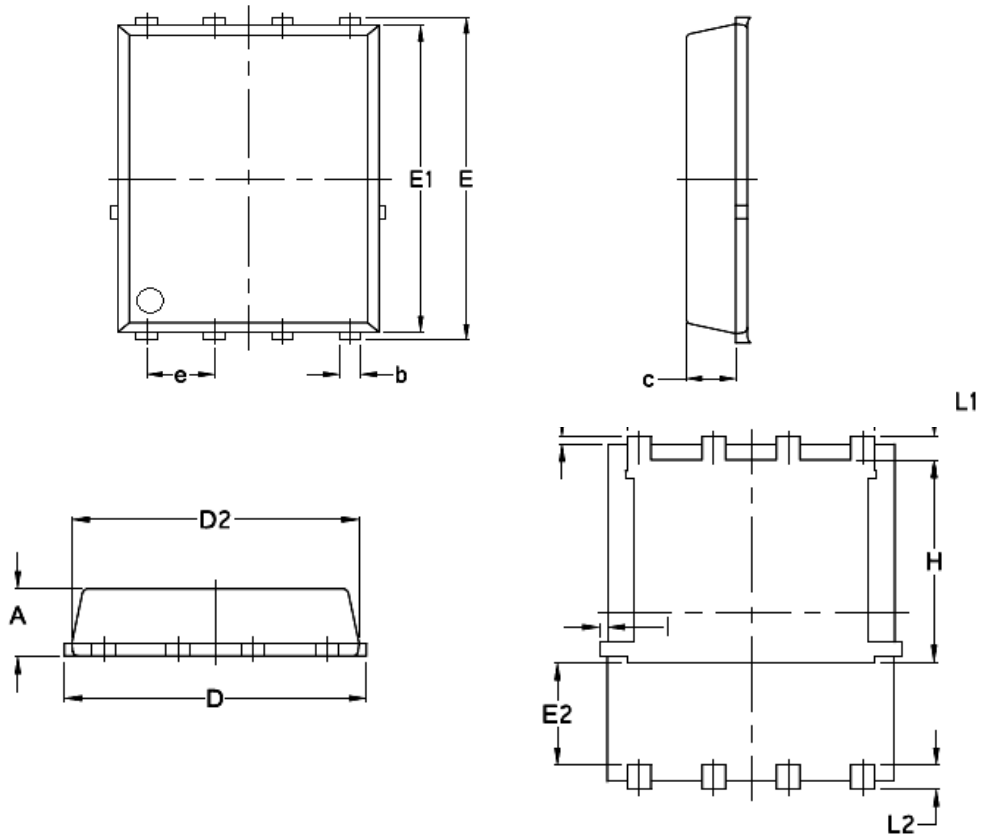


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds
Average Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.
Liquidous Temperature (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
PAP31TY13Y	DFN5X6A-EP1 Reel	3000 pcs

➤ Package Information ( DFN5X6A-EP1 )



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.03	1.17	0.0406	0.0461
b	0.34	0.48	0.0134	0.0189
c	0.824	0.970	0.0324	0.0382
D	4.80	5.40	0.1890	0.2126
D1	4.11	4.31	0.1618	0.1697
D2	4.80	5.00	0.1890	0.1969
I	---	0.18	---	0.0070
E	5.90	6.15	0.2323	0.2421
E1	5.65	5.85	0.2224	0.2303
E2	1.10	---	0.0433	---
e	1.27 BSC		0.05 BSC	
H	3.30	3.78	0.1299	0.1488
L	0.05	0.25	0.0020	0.0098
L1	0.38	0.61	0.0150	0.0240
L2	0.38	0.71	0.0150	0.0279

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