

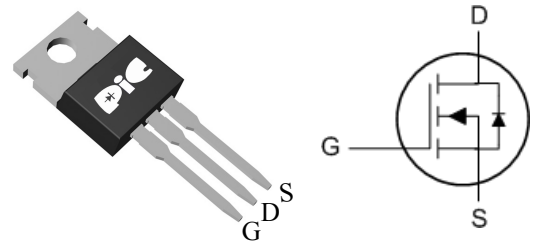
### ➤ General Description

This PAN40TG16G N-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
- TO-220 package design

### ➤ TO-220



### ➤ Application

- SMPS Power Supplier.
- Charger Adapter
- Power Tools
- LED Lighting

### ➤ Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current, $V_{GS} @ 10V_1$	$I_D @ T_C=25^\circ C$	90	A
Continuous Drain Current, $V_{GS} @ 10V_1$	$I_D @ T_C=100^\circ C$	57	A
Continuous Drain Current, $V_{GS} @ 10V_1$	$I_D @ T_A=25^\circ C$	13.6	A
Continuous Drain Current, $V_{GS} @ 10V_1$	$I_D @ T_A=70^\circ C$	11	A
Pulsed Drain Current <sup>2</sup>	$I_{DM}$	270	A
Single Pulse Avalanche Energy <sup>3</sup>	EAS	110	mJ
Avalanche Current	$I_{AS}$	47	A
Total Power Dissipation <sup>4</sup>	$P_D @ T_C=25^\circ C$	87	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>	$R_{\theta JC}$	1.44	$^\circ C/W$

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	40	---	---	V
BVDSS Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^\circ C, I_D=1mA$	---	0.034	---	$V/^\circ C$
Static Drain-Source On-Resistance <sup>2</sup>	$R_{DS(ON)}$	$V_{GS}=10V, I_D=30A$	---	---	6.5	m $\Omega$
		$V_{GS}=4.5V, I_D=20A$	---	---	8.5	
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	$\Delta V_{GS(th)}$		---	-5.84	---	$mV/^\circ C$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=32V, V_{GS}=0V, T_J=25^\circ C$	---	---	1	$\mu A$
		$V_{DS}=32V, V_{GS}=0V, T_J=55^\circ C$	---	---	5	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
Forward Transconductance	$g_{fs}$	$V_{DS}=5V, I_D=30A$	---	50	---	S
Gate Resistance	$R_g$	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	1.4	---	$\Omega$
Total Gate Charge (4.5V)	$Q_g$	$V_{DS}=32V, V_{GS}=4.5V, I_D=20A$	---	30	---	nC
Gate-Source Charge	$Q_{gs}$		---	7.2	---	
Gate-Drain Charge	$Q_{gd}$		---	13	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=20V, V_{GS}=10V, R_G=3.3\Omega, I_D=20A$	---	10	---	ns
Rise Time	$T_r$		---	34	---	
Turn-Off Delay Time	$T_{d(off)}$		---	56	---	
Fall Time	$T_f$		---	14.5	---	
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	3415	---	pF
Output Capacitance	$C_{oss}$		---	282	---	
Reverse Transfer Capacitance	$C_{rss}$		---	210	---	

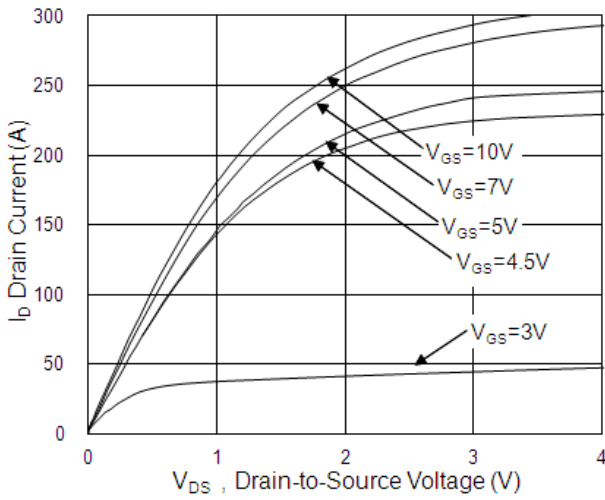
### ➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current <sup>1,5</sup>	$I_S$	$V_G=V_D=0V, \text{Force Current}$	---	---	90	A
Pulsed Source Current <sup>2,5</sup>	$I_{SM}$		---	---	270	A
Diode Forward Voltage <sup>2</sup>	$V_{SD}$	$V_{GS}=0V, I_S=1A, T_J=25^\circ C$	---	---	1	V
Reverse Recovery Time	$t_{rr}$	$I_F=30A, di/dt=100A/\mu s, T_J=25^\circ C$	---	4.5	---	nS
Reverse Recovery Charge	$Q_{rr}$		---	0.5	---	nC

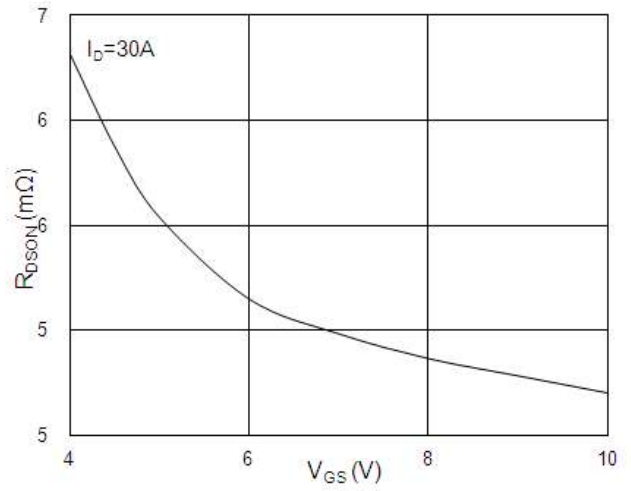
Note :

- 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.The EAS data shows Max. rating . The test condition is  $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=47A$
- 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.

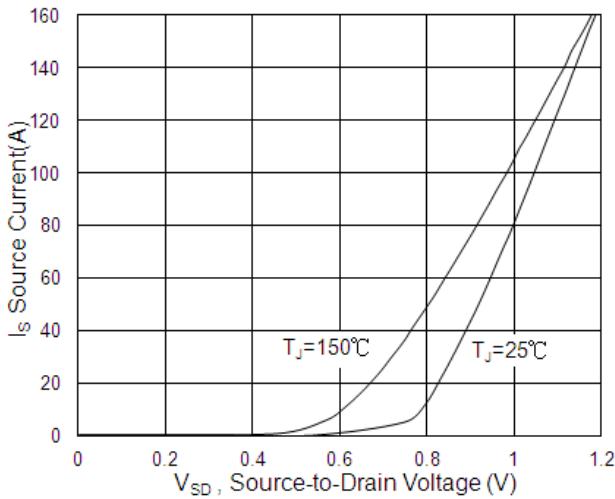
### ➤ Typical Characteristics



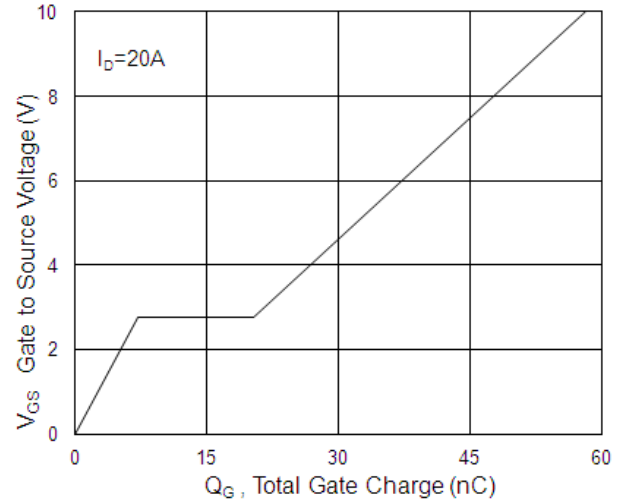
**Fig.1 Typical Output Characteristics**



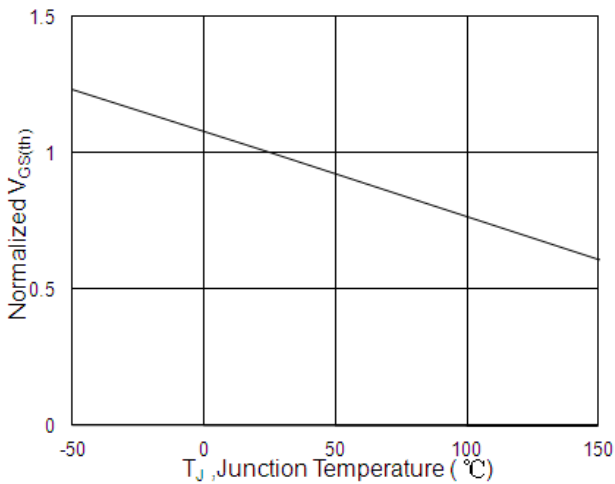
**Fig.2 On-Resistance vs. G-S Voltage**



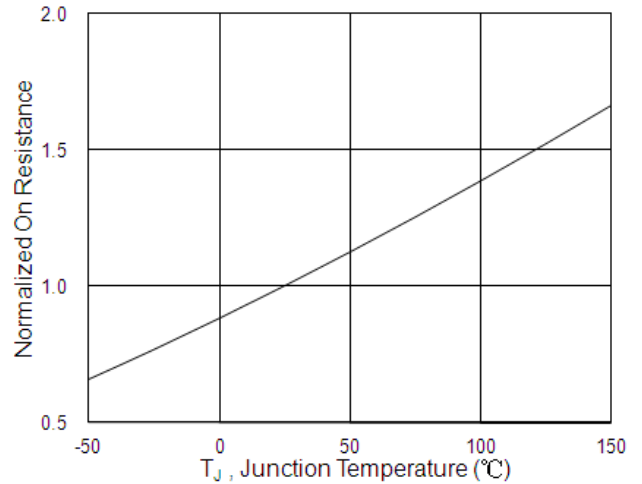
**Fig.3 Forward Characteristics Of Reverse**



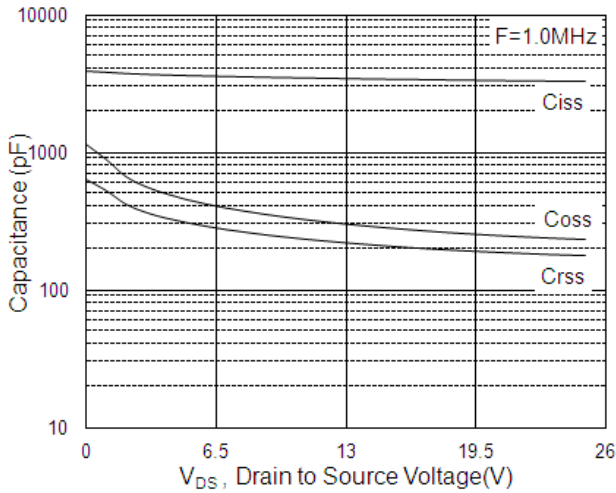
**Fig.4 Gate-Charge Characteristics**



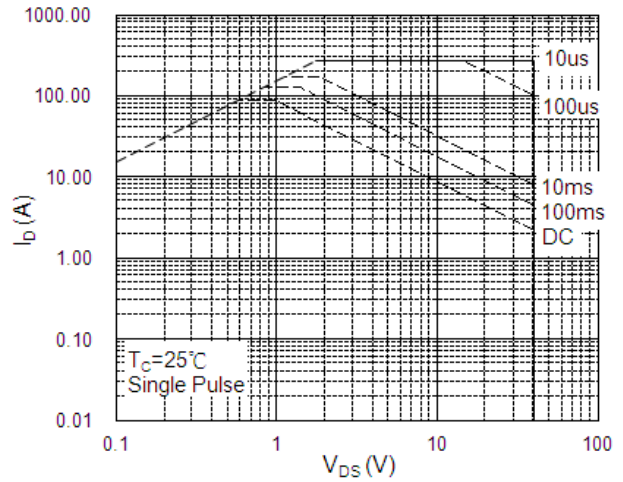
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



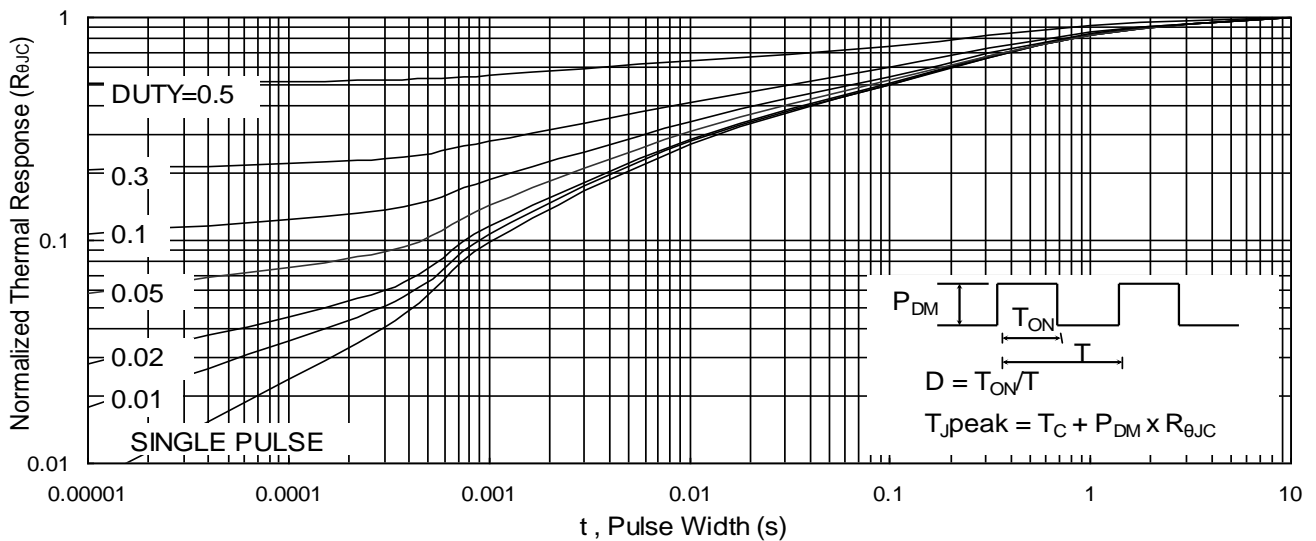
**Fig.6 Normalized  $R_{DSON}$  vs.  $T_J$**



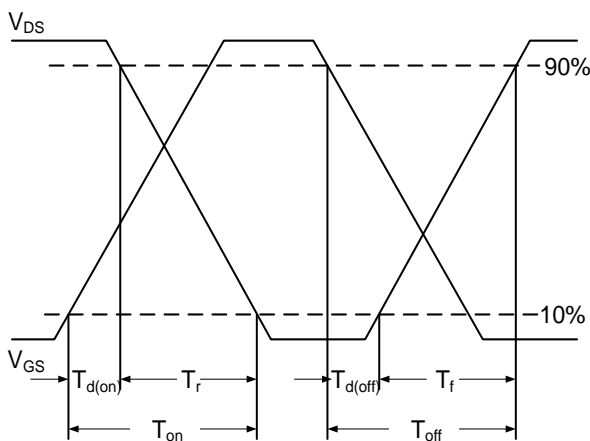
**Fig.7 Capacitance**



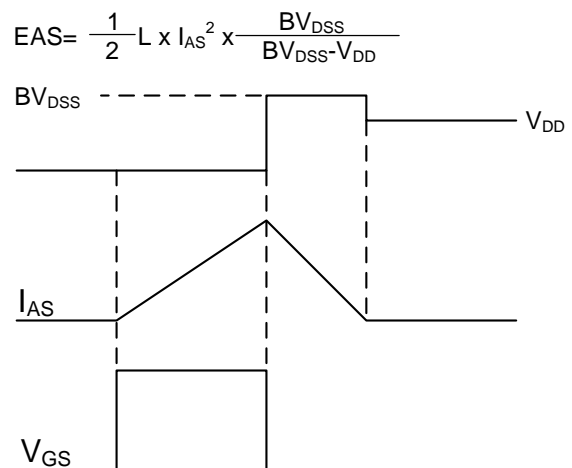
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

➤ Recommend IR Reflow Soldering Thermal Profile

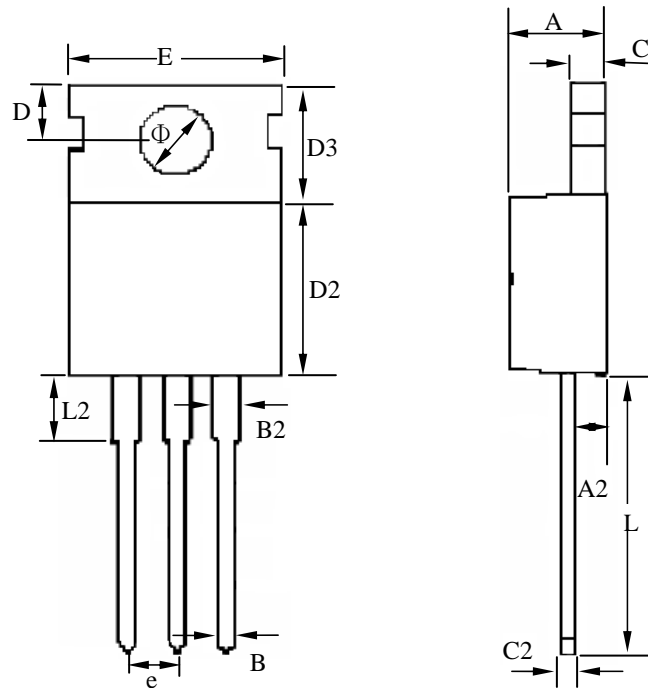


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds
Average Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.
Liquidous Temperature (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
PAN40TG16G	TO-220	50 pcs/tube

### ➤ Package Information ( TO-220 )



SYMBOLS	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.25	--	4.80	0.167	--	0.189
A2	2.20	--	2.92	0.087	--	0.115
B	0.70	--	0.91	0.028	--	0.036
B2	1.15	--	1.77	0.045	--	0.070
C	1.20	--	1.40	0.047	--	0.055
C2	0.45	--	0.61	0.018	--	0.024
D	2.54	--	3.00	0.100	--	0.118
D2	8.39	--	9.47	0.330	--	0.373
D3	6.30	--	6.70	0.248	--	0.264
E	9.70	--	10.36	0.382	--	0.408
L	12.75	--	14.40	0.502	--	0.567
L2	2.45	--	4.05	0.096	--	0.159
$\Phi$	3.50	--	3.80	0.138	--	0.150
e	--	2.54	--	--	0.100	--

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