

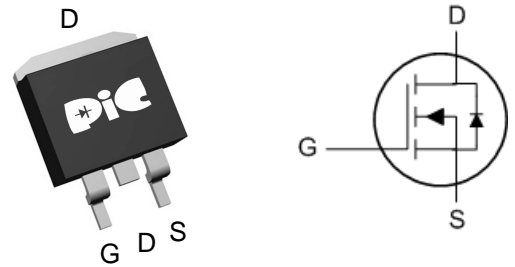
➤ General Description

This PAN60TP40P N-Channel enhancement mode power field effect transistor is the high density technology and this advanced technology can provide excellent Rds(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
- Green Device Available Excellent
- Cdv/dt effect decline
- Advanced high cell densit Trench
- TO-263-2L package design

➤ TO-263-2L



➤ Application

- DC-DC Converters
- Power Management
- Analog Switch

➤ Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current, V_{GS} @ 10V ₁	$I_D@T_C=25^\circ C$	140	A
Continuous Drain Current, V_{GS} @ 10V ₁	$I_D@T_C=100^\circ C$	90	A
Pulsed Drain Current ₂	I_{DM}	300	A
Single Pulse Avalanche Energy ₃	EAS	125	mJ
Avalanche Current	I_{AS}	50	A
Total Power Dissipation ₄	$P_D@T_C=25^\circ C$	166	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 ₁	$R_{\theta JA}$	62	$^\circ C/W$
Thermal Resistance Junction-Case ₁	$R_{\theta JC}$	0.75	$^\circ C/W$

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	60	---	---	V
Static Drain-Source On-Resistance ²	$R_{DS(ON)}$	$V_{GS}=10V, I_D=30A$	---	4.3	5.2	$m\Omega$
		$V_{GS}=4.5V, I_D=20A$	---	6	7	$m\Omega$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	1.2	---	2.5	V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=48V, V_{GS}=0V, T_J=25^\circ C$	---	---	1	μA
		$V_{DS}=48V, V_{GS}=0V, T_J=55^\circ C$	---	---	5	
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
Forward Transconductance	g_{fs}	$V_{DS}=10V, I_D=30A$	---	75	---	S
Gate Resistance	R_g	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	0.7	---	Ω
Total Gate Charge (10V)	Q_g	$V_{DS}=48V, V_{GS}=10V, I_D=25A$	---	75	---	nC
Gate-Source Charge	Q_{gs}		---	15.5	---	
Gate-Drain Charge	Q_{gd}		---	20.3	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=30V, V_{GS}=10V, R_G=3.3\Omega, I_D=30A$	---	18.5	---	ns
Rise Time	T_r		---	8.8	---	
Turn-Off Delay Time	$T_{d(off)}$		---	58.8	---	
Fall Time	T_f		---	15.8	---	
Input Capacitance	C_{iss}	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	4706	---	pF
Output Capacitance	C_{oss}		---	325	---	
Reverse Transfer Capacitance	C_{rss}		---	245	---	

➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current ^{1,5}	I_S	$V_G=V_D=0V$, Force Current	---	---	140	A
Diode Forward Voltage ²	V_{SD}	$V_{GS}=0V, I_S=1A, T_J=25^\circ C$	---	---	1.2	V
Reverse Recovery Time	t_{rr}	$I_F=30A, di/dt=100A/\mu s, T_J=25^\circ C$	---	22.9	---	nS
Reverse Recovery Charge	Q_{rr}		---	11.6	---	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 $V_{DD}=50V, V_{GS}=10V, L=0.1mH, I_{AS}=50A$
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

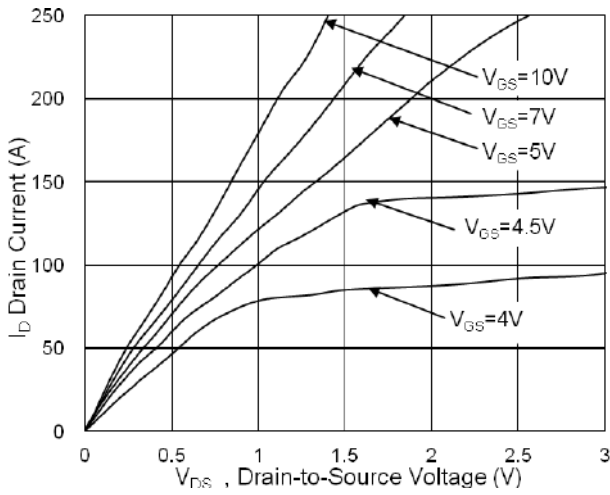


Fig.1 Typical Output Characteristics

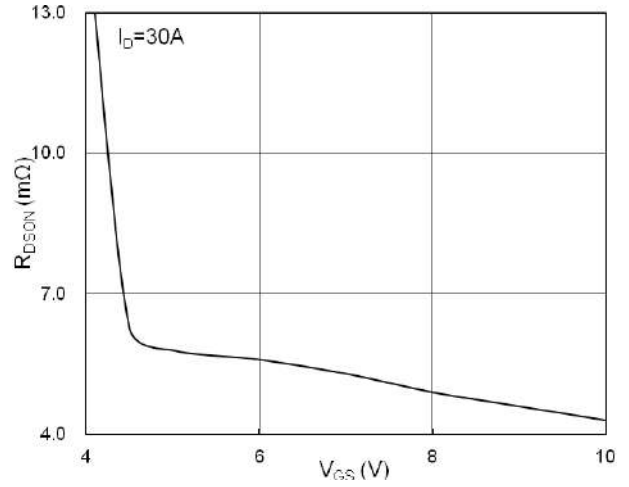


Fig.2 On-Resistance v.s Gate-Source

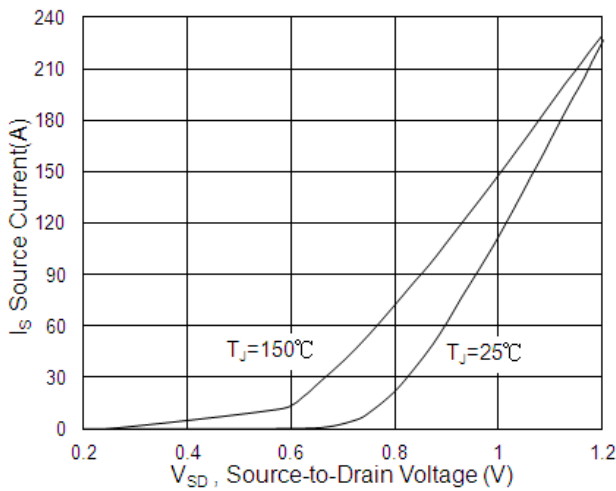


Fig.3 Forward Characteristics of Reverse

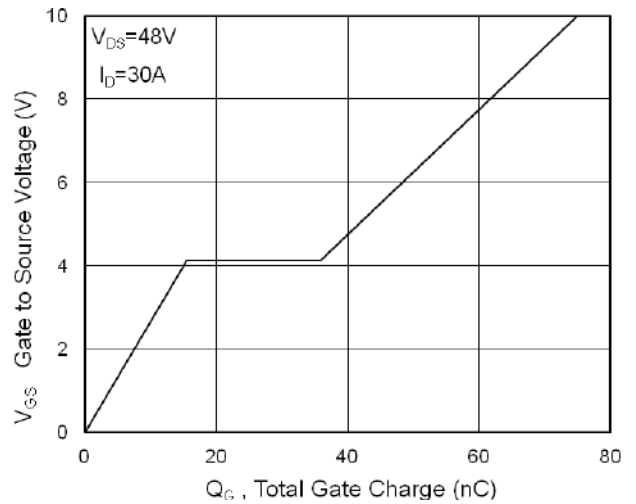


Fig.4 Gate-Charge Characteristics

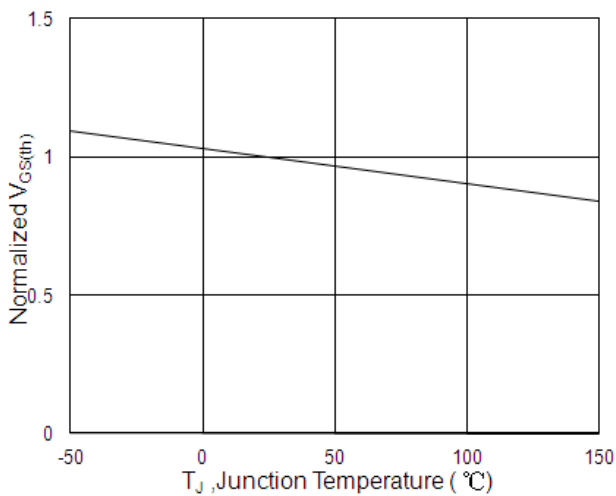


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

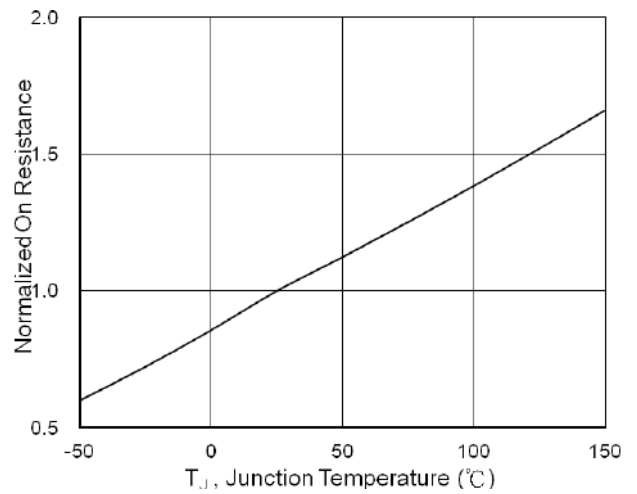


Fig.6 Normalized $R_{DS(ON)}$ vs. T_J

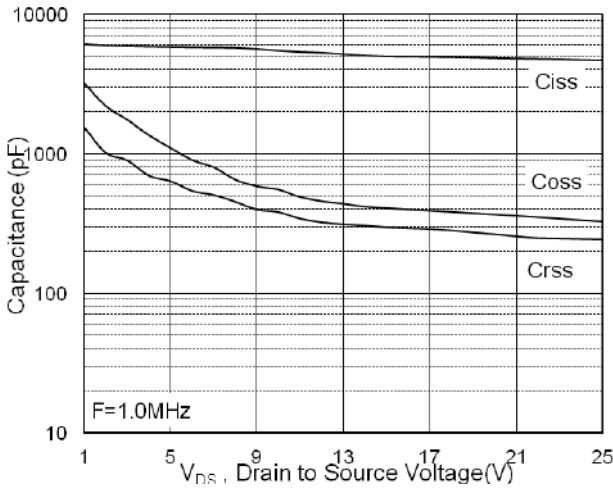


Fig.7 Capacitance

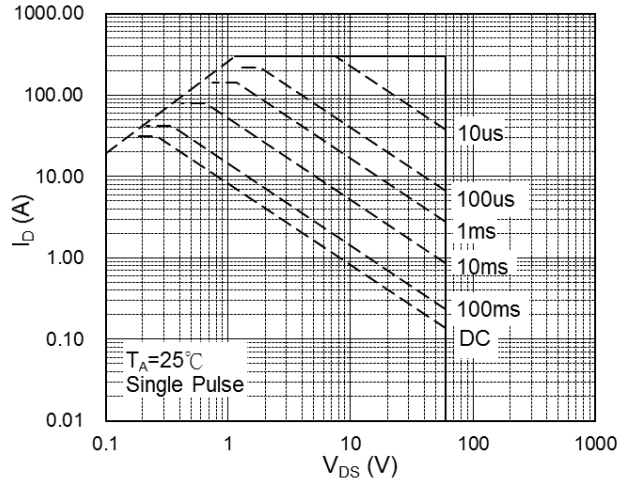


Fig.8 Safe Operating Area

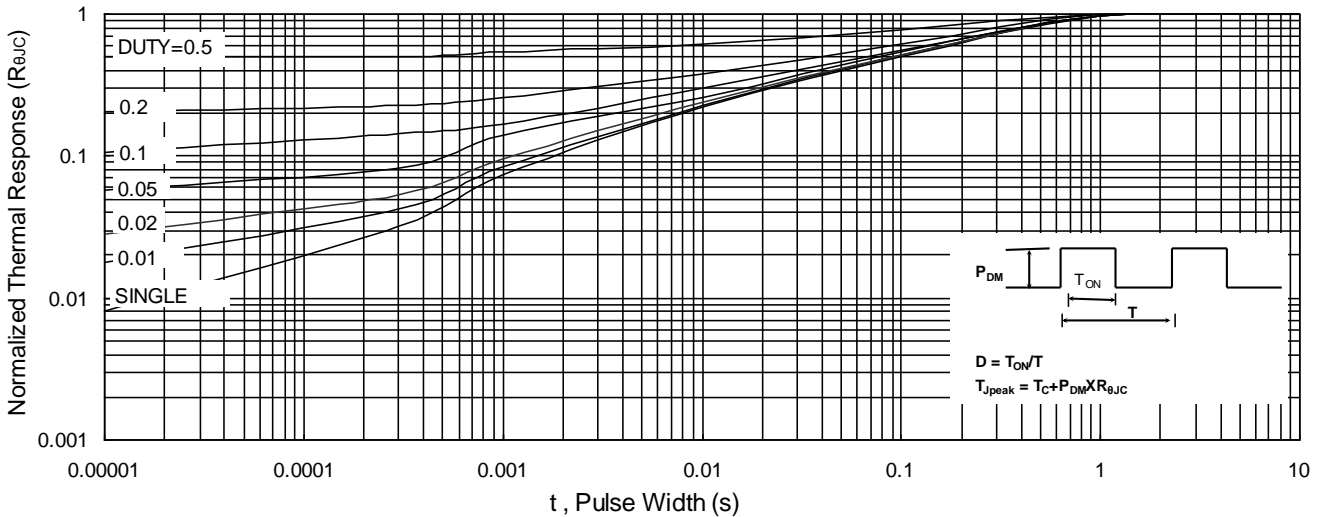


Fig.9 Normalized Maximum Transient Thermal Impedance

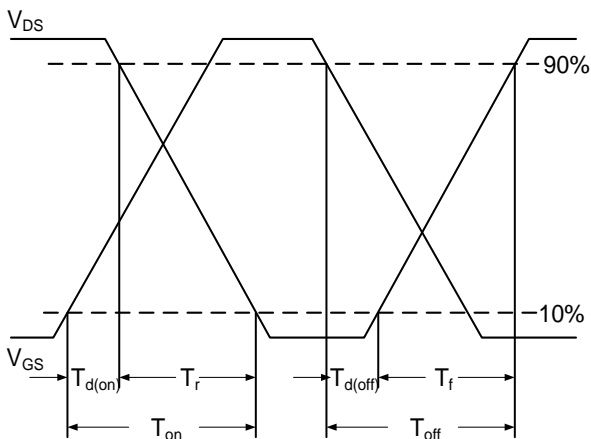


Fig.10 Switching Time Waveform

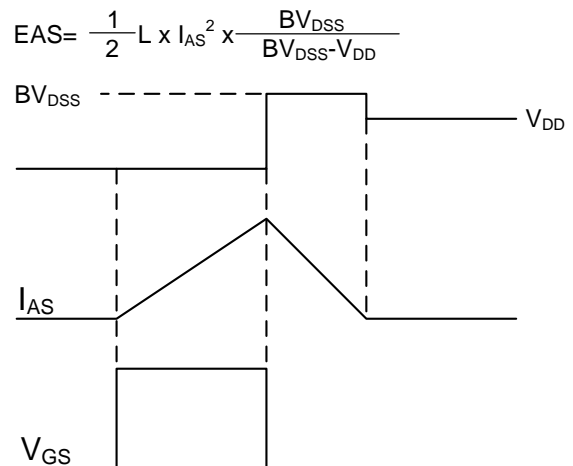


Fig.11 Unclamped Inductive Switching Waveform

➤ Recommend IR Reflow Soldering Thermal Profile

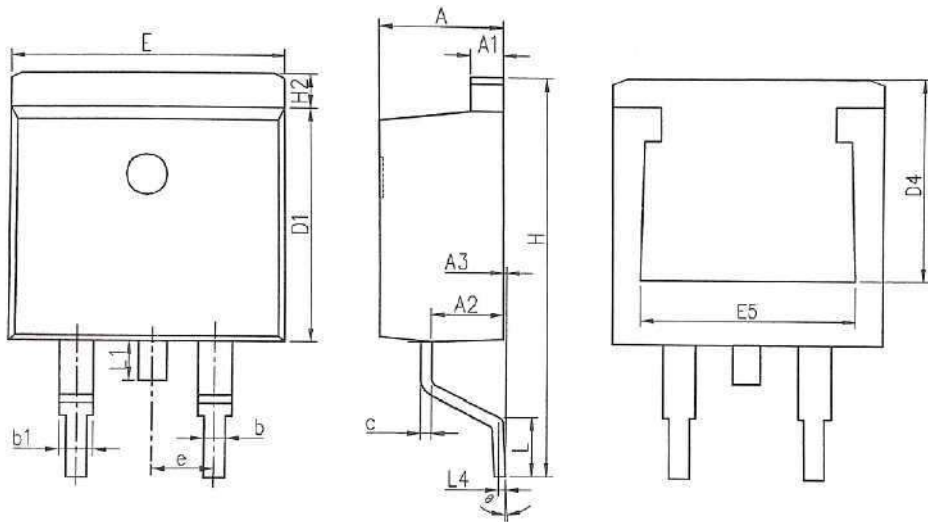


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T _{smin})	150°C
Temperature Max. (T _{smax})	200°C
Time (t _s) from (T _{smin} to T _{smax})	60-120 seconds
Average Ramp-up Rate (t _L to t _P)	3°C/second max.
Liquidous Temperature (T _L)	217°C
Time (t _L) Maintained Above (T _L)	60 – 150 seconds
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
PAN60TP40P	TO-263-2L Reel	800

➤ Package Information (TO-263-2L)



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.370	4.770	0.172	0.188
A1	1.220	1.420	0.048	0.056
A2	2.200	2.890	0.087	0.114
A3	0.000	0.250	0.000	0.010
b	0.700	0.960	0.028	0.038
b1	1.170	1.470	0.046	0.058
c	0.300	0.530	0.012	0.021
D1	8.500	9.300	0.335	0.366
D4	6.600	-	0.260	-
E	9.860	10.36	0.388	0.408
E5	7.060	-	0.278	-
e	2.540 BSC		0.100 BSC	
H	14.70	15.70	0.579	0.618
H2	1.070	1.470	0.042	0.058
L	2.000	2.600	0.079	0.102
L1	1.400	1.750	0.055	0.069
L4	0.250 BSC		0.010 BSC	
θ	0°	9°	0°	9°

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