

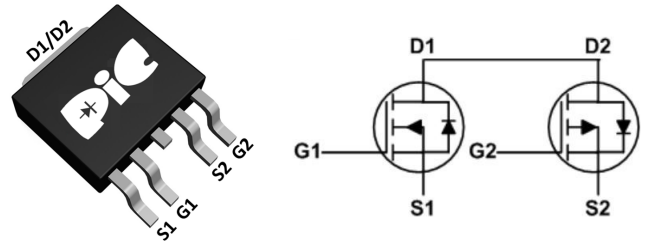
➤ General Description

This PAC39TX03X N&P Channel enhancement mode power field effect transistor is the high density trench 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
- 100% EAS Guaranteed
- Green Device Available
- Excellent CdV/dt effect decline
- Advanced high cell density Trench technology

➤ TO-252-4L



➤ Application

- Inverter
- H-Bridge

➤ Absolute Maximum Ratings

Parameter	Symbol	Rating		Units
		N-Ch	P-Ch	
Drain-Source Voltage	V_{DS}	30	-30	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current, $V_{GS} @ 10V^1$	$I_D @ T_C=25^\circ C$	30	-24	A
Continuous Drain Current, $V_{GS} @ 10V^1$	$I_D @ T_C=100^\circ C$	18	-19	A
Pulsed Drain Current ²	I_{DM}	60	-50	A
Single Pulse Avalanche Energy ³	EAS	22	45	mJ
Avalanche Current	I_{AS}	21	-30	A
Total Power Dissipation ⁴	$P_D @ T_C=25^\circ C$	25	25	W
Storage Temperature Range	T_{STG}	-55 to 150	-55 to 150	$^\circ C$
Operating Junction Temperature Range	T_J	-55 to 150	-55 to 150	$^\circ C$
Thermal Resistance Junction-Ambient ¹	$R_{\theta JA}$	62		$^\circ C/W$
Thermal Resistance Junction-Case ¹	$R_{\theta JC}$	5		$^\circ C/W$

➤ N-Channel Electrical Characteristics (T_J=25°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
BVDSS Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to 25°C, $I_D=1mA$	---	0.023	---	V/°C
Static Drain-Source On-Resistance ²	$R_{DS(ON)}$	$V_{GS}=10V, I_D=12A$	---	---	18	mΩ
		$V_{GS}=4.5V, I_D=10A$	---	---	28	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	1.0	---	2.5	V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}$		---	-5.2	---	mV/°C
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=32V, V_{GS}=0V, T_J=25^\circ C$	---	---	1	μA
		$V_{DS}=32V, V_{GS}=0V, T_J=55^\circ C$	---	---	5	
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	±100	nA
Forward Transconductance	g_{fs}	$V_{DS}=5V, I_D=12A$	---	10	---	S
Gate Resistance	R_g	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	2.5	5	Ω
Total Gate Charge (4.5V)	Q_g	$V_{DS}=20V, V_{GS}=4.5V, I_D=12A$	---	7.2	---	nC
Gate-Source Charge	Q_{gs}		---	1.4	---	
Gate-Drain Charge	Q_{gd}		---	2.2	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=20V, V_{GS}=10V, R_G=3.3\Omega, I_D=1A$	---	4.1	---	ns
Rise Time	T_r		---	9.8	---	
Turn-Off Delay Time	$T_{d(off)}$		---	15.5	---	
Fall Time	T_f		---	6.0	---	
Input Capacitance	C_{iss}	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	572	---	pF
Output Capacitance	C_{oss}		---	81	---	
Reverse Transfer Capacitance	C_{rss}		---	65	---	

➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current ^{1,5}	I_S	$V_G=V_D=0V, \text{Force Current}$	---	---	30	A
Pulsed Source Current ^{2,5}	I_{SM}		---	---	60	A
Diode Forward Voltage ²	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 $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=21A$
4. Ensure that the channel temperature does not exceed 150°C.
5. The data is theoretically the same as ID and IDM, in real applications, should be limited by total power dissipation.

➤ P-Channel Electrical Characteristics (T_J=25° C Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =-250uA	-30	---	---	V
BV _{DSS} Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to 25°C, I _D =-1mA	---	-0.021	---	V/°C
Static Drain-Source On-Resistance ²	R _{DS(ON)}	V _{GS} =-10V, I _D =-8A	---	---	30	mΩ
		V _{GS} =-4.5V, I _D =-4A	---	---	55	
Gate Threshold Voltage	V _{GS(th)}	V _{GS} =V _{DS} , I _D =-250uA	-1.0	---	-2.5	V
V _{GS(th)} Temperature Coefficient	$\Delta V_{GS(th)}$		---	-4.2	---	mV/°C
Drain-Source Leakage Current	I _{DSS}	V _{DS} =-32V, V _{GS} =0V, T _J =25°C	---	---	1	uA
		V _{DS} =-32V, V _{GS} =0V, T _J =55°C	---	---	5	
Gate-Source Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	---	---	100	nA
Forward Transconductance	g _{fs}	V _{DS} =-5V, I _D =-8A	---	15	---	S
Gate Resistance	R _g	V _{DS} =0V, V _{GS} =0V, f=1MHz		15	30	Ω
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} =-15V, V _{GS} =-10V, R _G =3.3Ω, 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 ^{1,5}	I _S	V _G =V _D =0V, Force Current	---	---	-24	A
Pulsed Source Current ^{2,5}	I _{SM}		---	---	-50	A
Diode Forward Voltage ²	V _{SD}	V _{GS} =0V, I _S =-1A, T _J =25°C	---	---	-1.2	V

Note :

- 1.Pulse width limited by maximum junction temperature.
- 2.The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 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°C.
- 5.The data is theoretically the same as I_D and I_{DM}, in real applications, should be limited by total power dissipation.

N-Channel Typical Characteristics

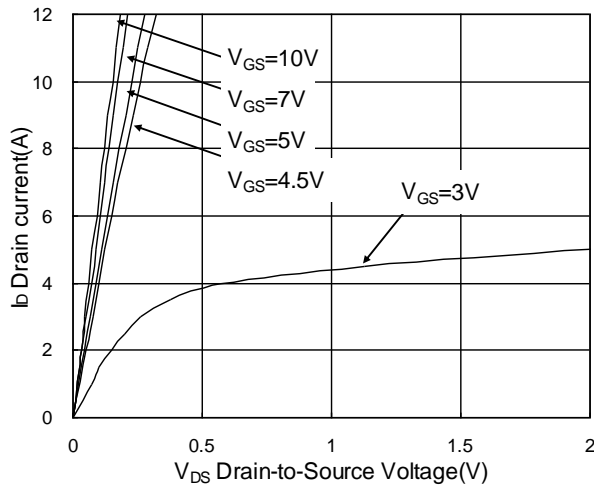


Fig.1 Typical Output Characteristics

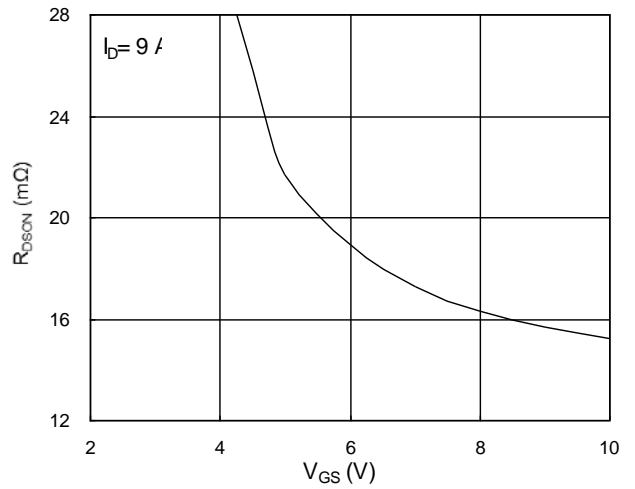


Fig.2 On-Resistance v.s Gate-Source

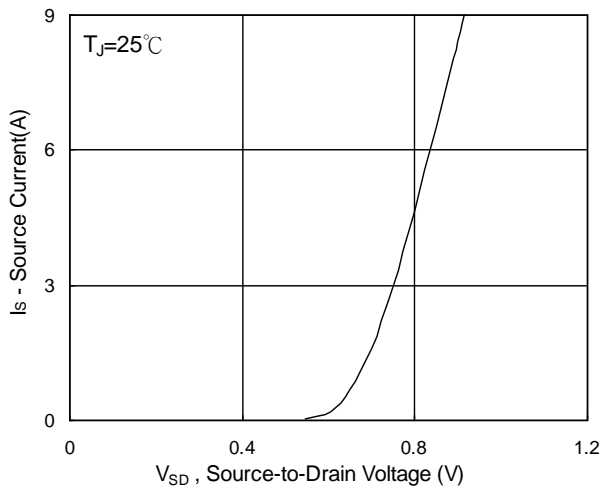


Fig.3 Forward Characteristics Of Reverse

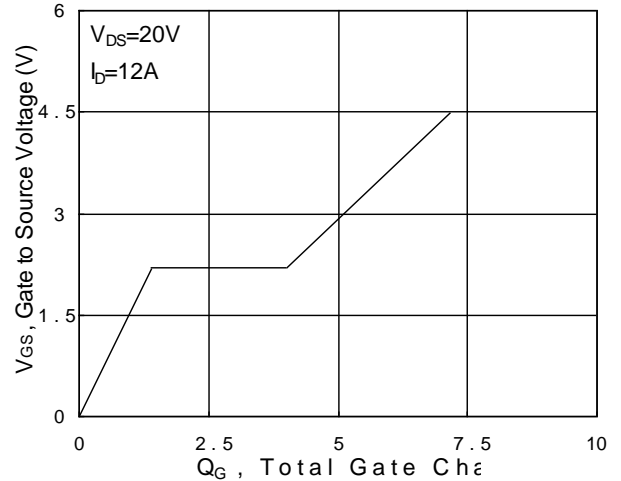


Fig.4 Gate-Charge characteristics

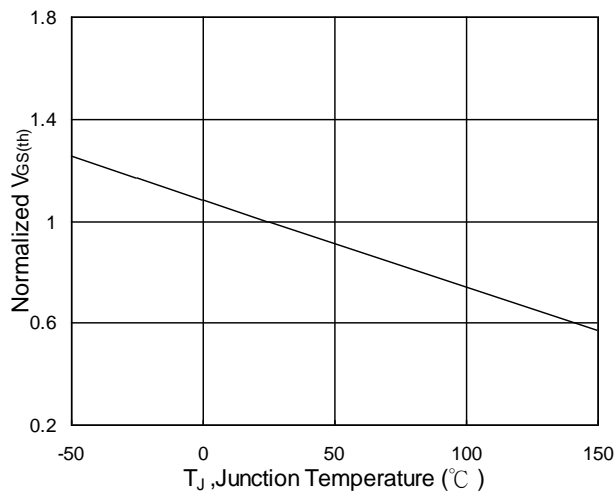


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

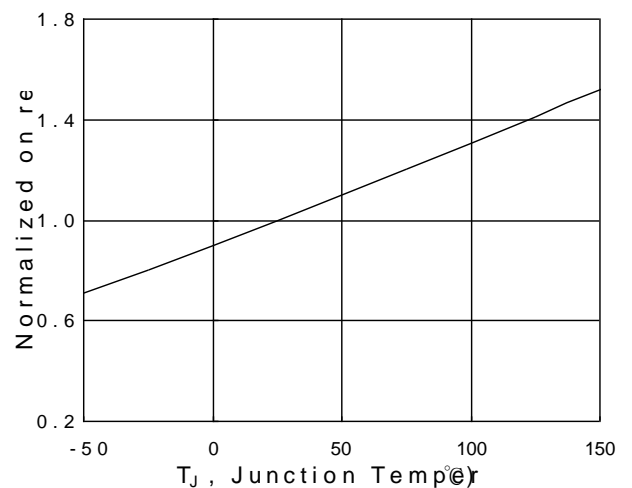


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

N-Ch and P-Ch Fast Switching MOSFET

$V_{DS}=30V, I_D=30A, R_{DS(ON)}=18m\Omega$

$V_{DS}=-30V, I_D=-24A, R_{DS(ON)}=30m\Omega$

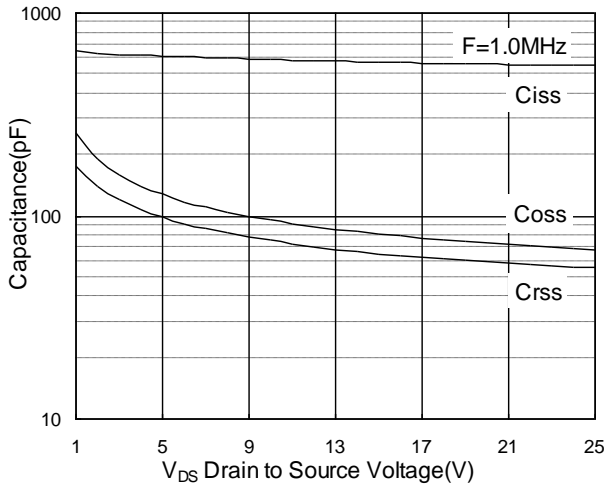


Fig.7 Capacitance

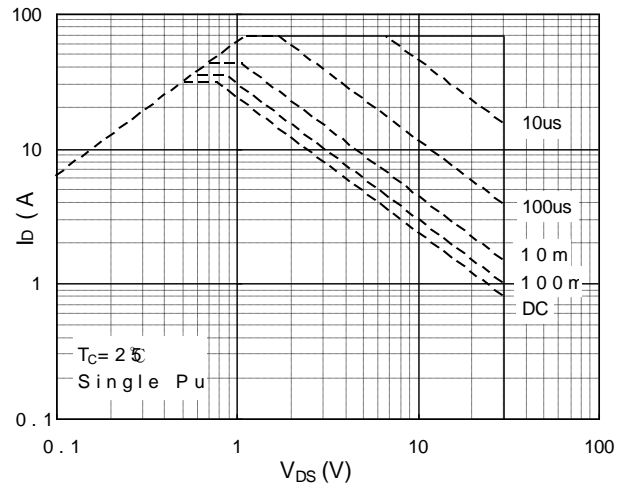


Fig.8 Safe Operating Area

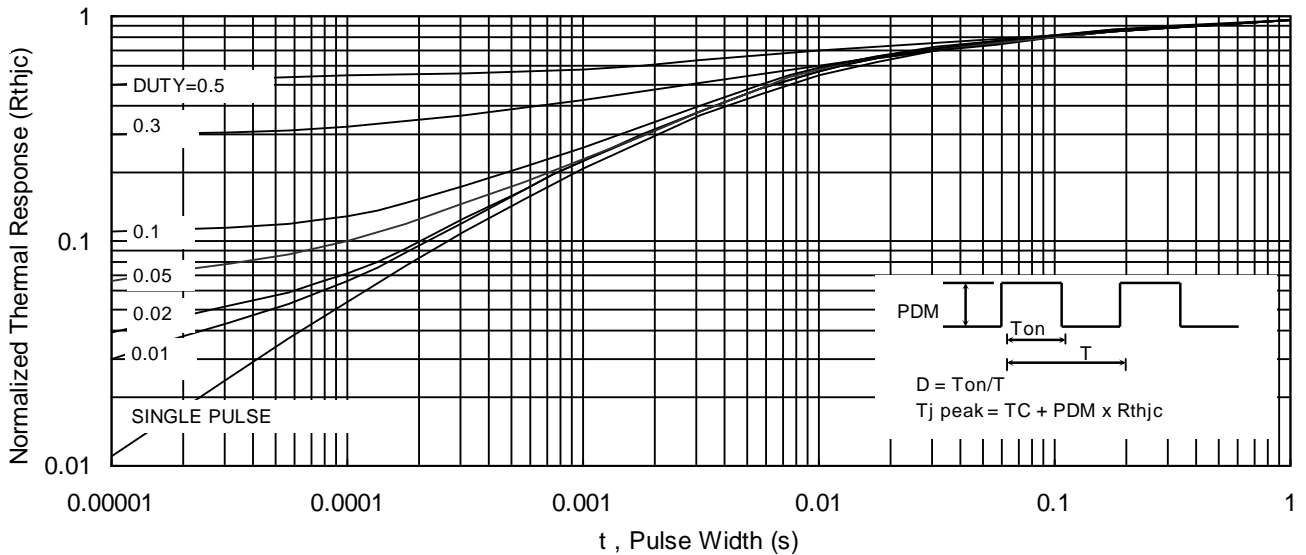


Fig.9 Normalized Maximum Transient Thermal Impedance

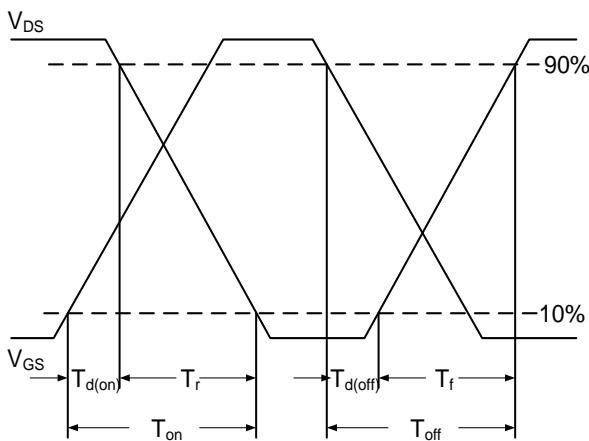


Fig.10 Switching Time Waveform

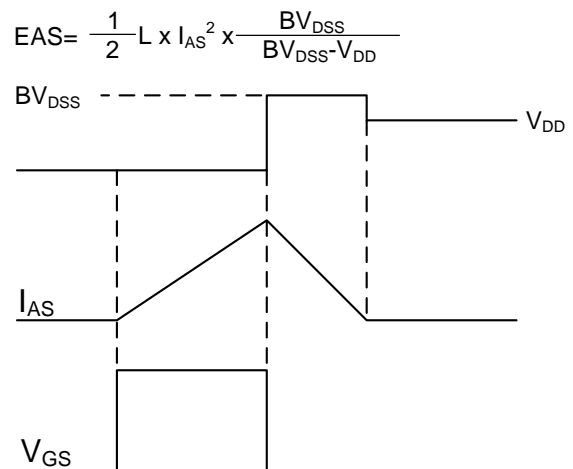


Fig.11 Unclamped Inductive Waveform

➤ P-Channel Typical Characteristics

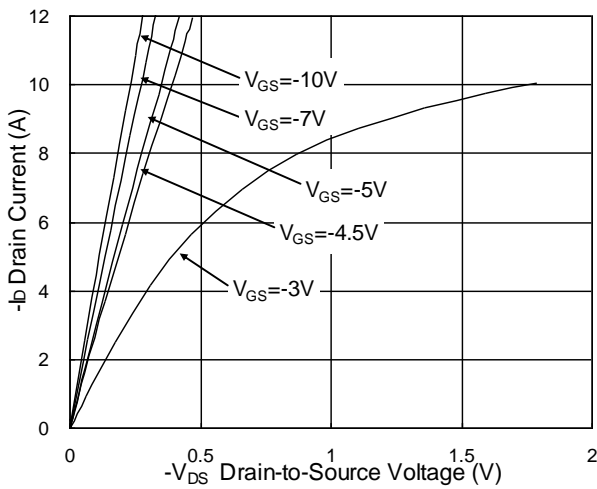


Fig.1 Typical Output Characteristics

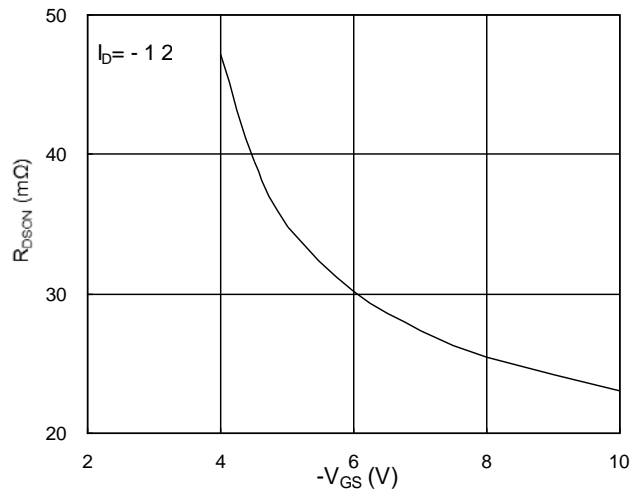


Fig.2 On-Resistance v.s Gate-Source

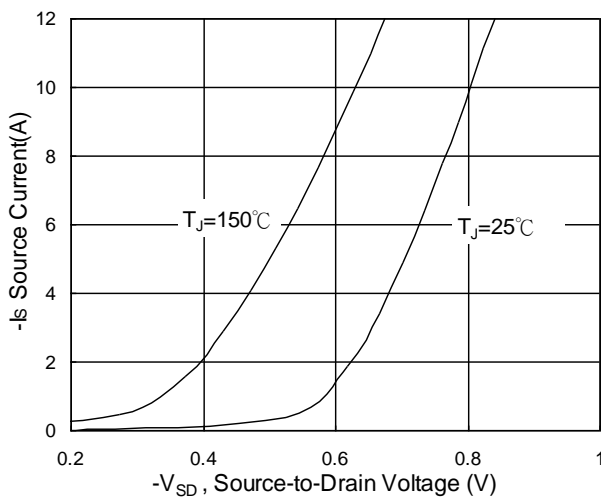


Fig.3 Forward Characteristics Of Reverse

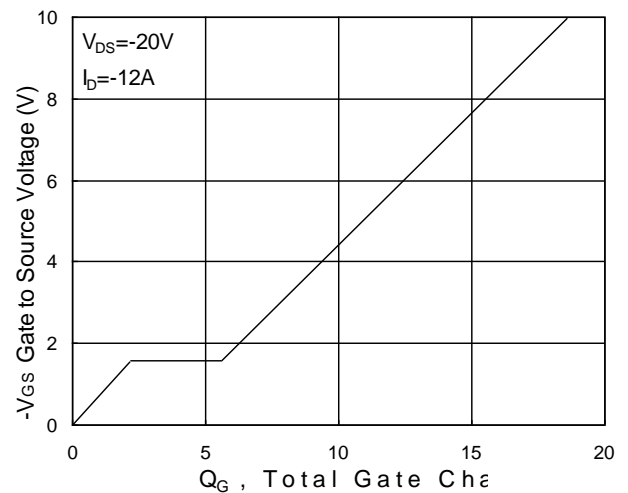


Fig.4 Gate-Charge Characteristics

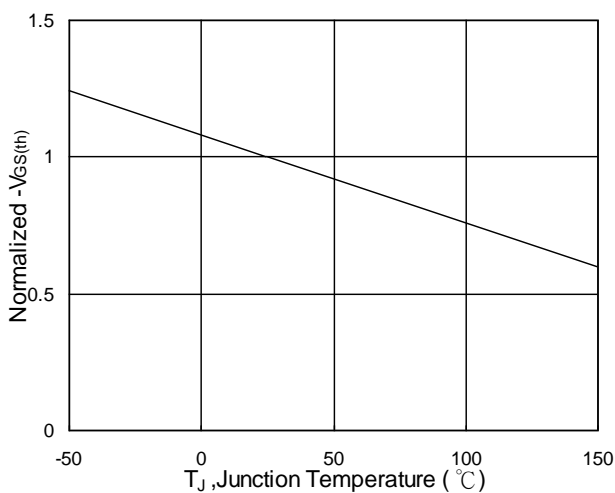


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

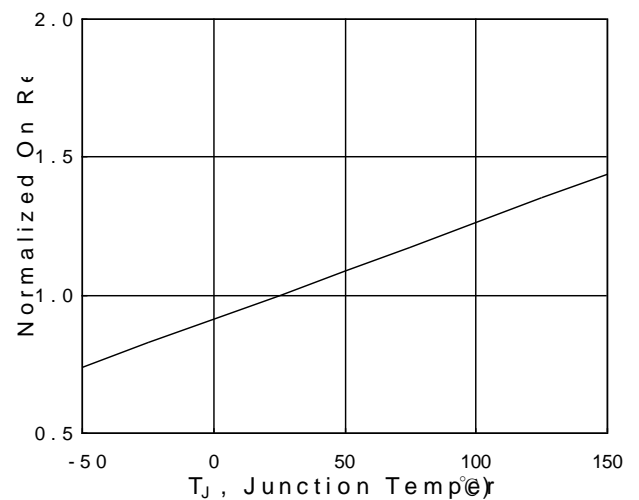


Fig.6 Normalized $R_{DS(ON)}$ v.s T_J

N-Ch and P-Ch Fast Switching MOSFET

$V_{DS}=30V, I_D=30A, R_{DS(ON)}=18m\Omega$

$V_{DS}=-30V, I_D=-24A, R_{DS(ON)}=30m\Omega$

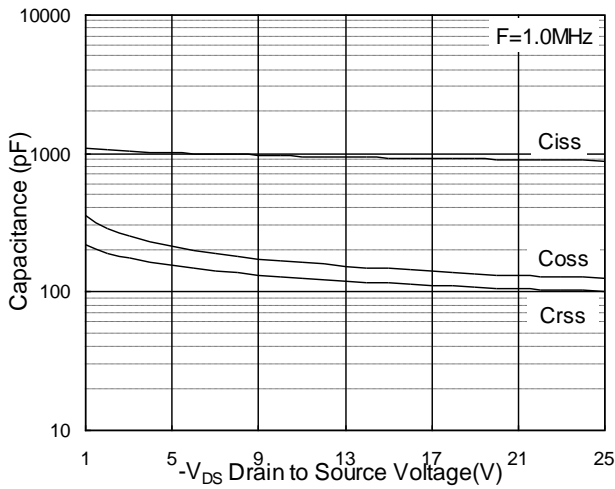


Fig.7 Capacitance

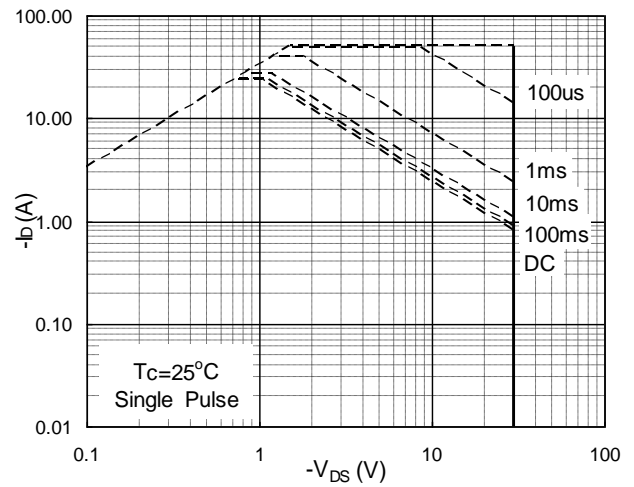


Fig.8 Safe Operating Area

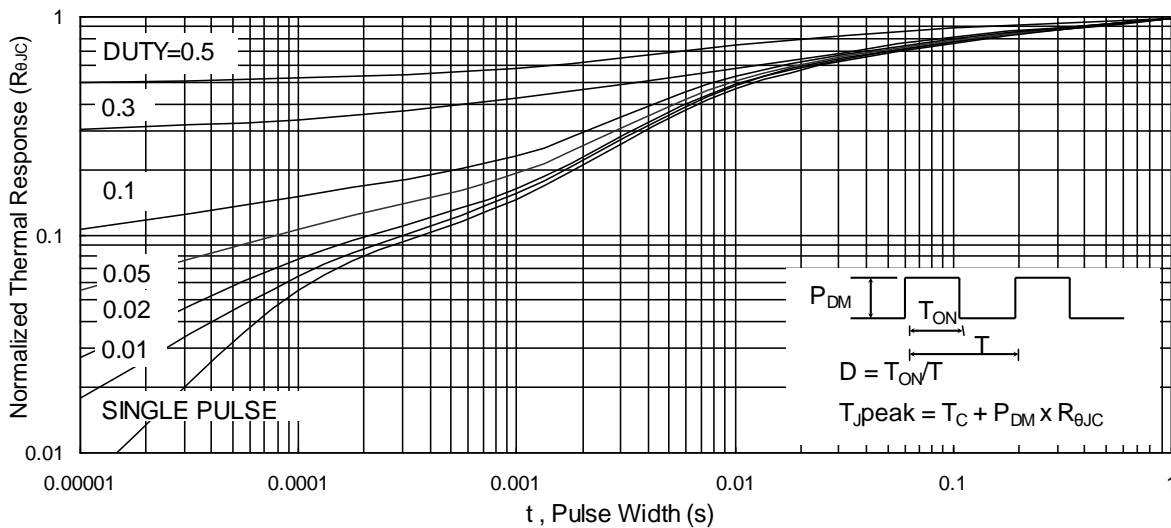


Fig.9 Normalized Maximum Transient Thermal Impedance

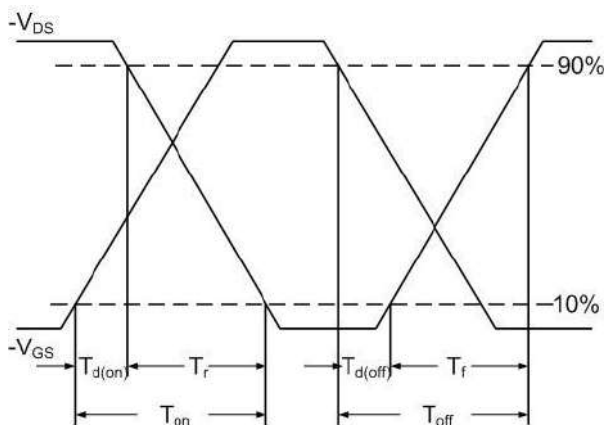


Fig.10 Switching Time Waveform

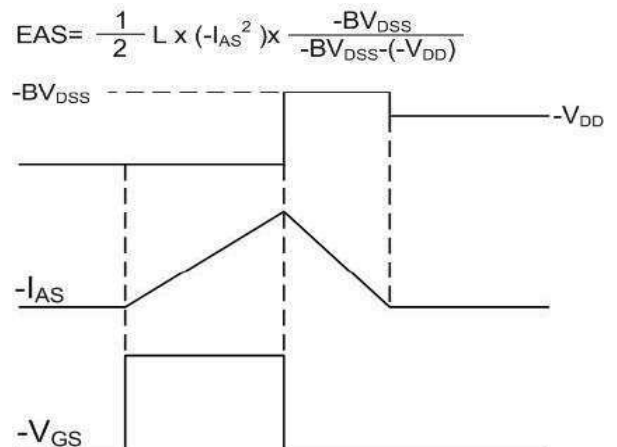
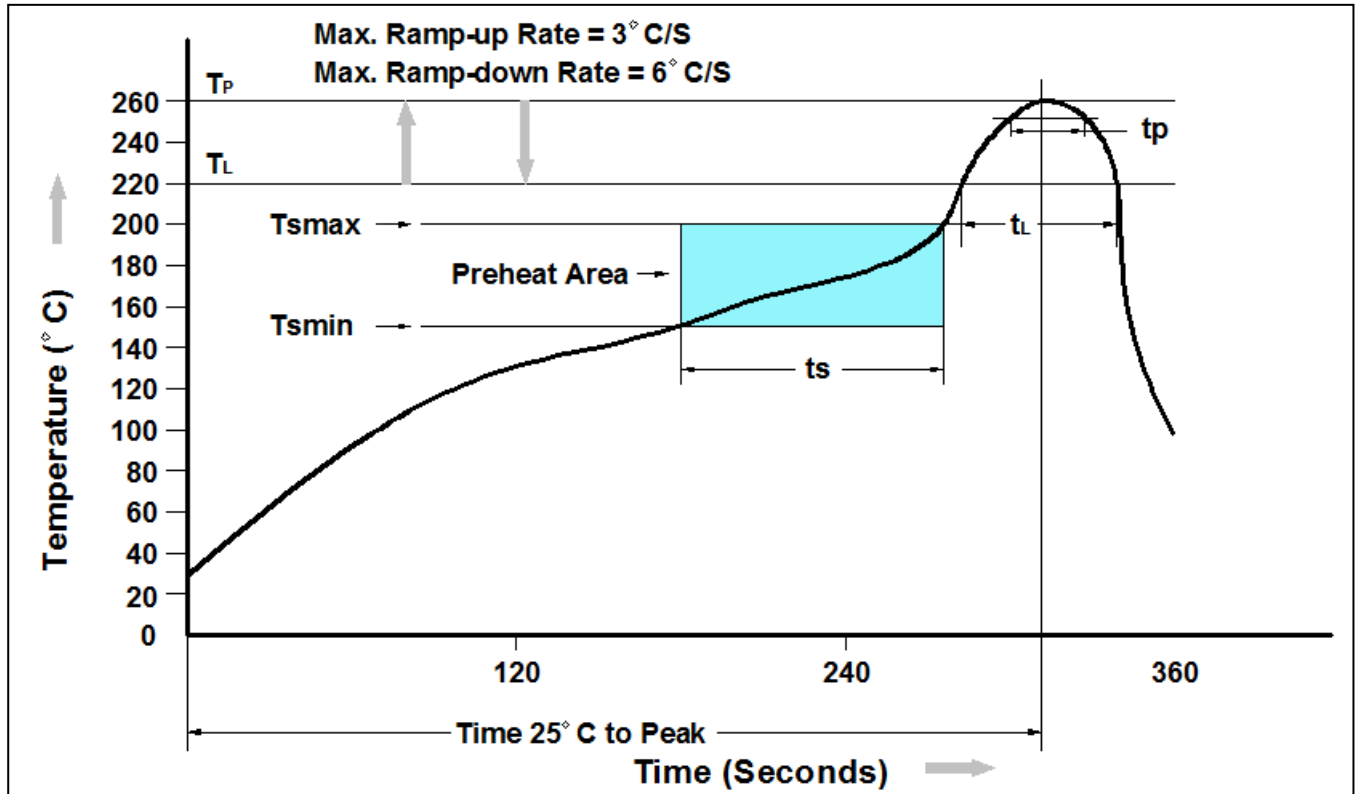


Fig.11 Unclamped Inductive Waveform

➤ Recommend IR Reflow Soldering Thermal Profile

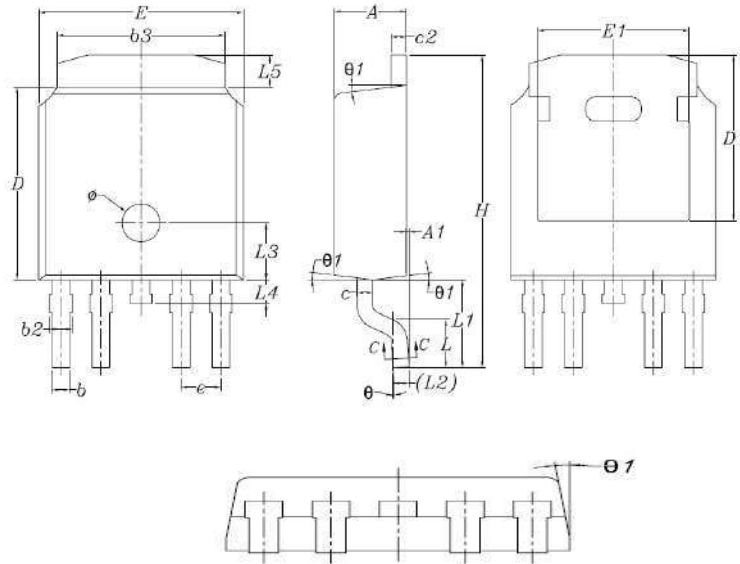


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T _{smin})	150°C
Temperature Max. (T _{smax})	200°C
Time (t _s) from (T _{smin} to T _{smax})	60-120 seconds
Average Ramp-up Rate (t _L to t _P)	3°C/second max.
Liquidous Temperature (T _L)	217°C
Time (t _L) Maintained Above (T _L)	60 – 150 seconds
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
PAC39TX03X	TO-252-4L Reel	2500 pcs

➤ Package Information (TO-252-4L)



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.180	2.400	0.0860	0.0950
A1	-	0.127	-	0.0050
b	0.508	0.711	0.0200	0.0280
b2	0.610	0.790	0.0240	0.0310
b3	5.184	5.461	0.2041	0.2150
c	0.460	0.610	0.0181	0.024
c2	0.460	0.610	0.0181	0.024
D	6.000	6.223	0.2362	0.2450
D1	5.050	--	0.1988	--
E	6.350	6.731	0.2500	0.2650
E1	4.320	--	0.1700	--
e	1.170	1.370	0.0461	0.0539
H	9.500	10.300	0.3740	0.4055
L	1.380	1.780	0.0540	0.0700
L1	2.400	3.000	0.0945	0.1181
L2	0.508BSC		0.020BSC	
L3	1.600	2.000	0.0630	0.0787
L4	--	1.016	--	0.04
L5	0.889	1.270	0.035	0.05
theta	0°	10°	0°	10°
theta1	0°	15°	0°	15°
phi	1.050	1.350	0.0413	0.0531

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