N-Ch and P-Ch Fast Switching MOSFET

V_{DS}=60V, I_D=23A, $RDS_{(ON)}$=32mΩ

V_{DS}=-60V, I_D=-18A, $RDS_{(ON)}$=70mΩ

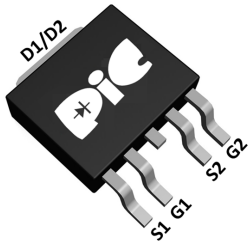
➢ General Description

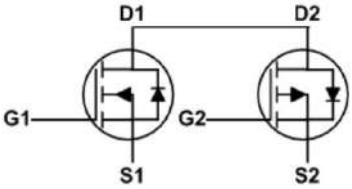
This PAC69TX01X N&P Channel enhancement mode power field effect transistor is the high density trench technology and this advanced technology can provide excellent Rds(On) performance and efficiency for power switching and load switching application., this device also comply with the RoHS and Green Product 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 (ð >





➢ Application

●Inverter
●H-Bridge

➢ Absolute Maximum Ratings

Parameter	Symbol	Rating		Units
		N-Channel	P-Channel	
Drain-Source Voltage	V_{DS}	60	-60	V
Gate-Source Voltage	V_{GS}	±20	±20	V
Continuous Drain Current, V_{GS} @ 10V1	I_D@T_C=25°C	23	-18	A
Continuous Drain Current, V_{GS} @ 10V1	I_D@T_C=100°C	15	-11	A
Continuous Drain Current, V_{GS} @ 10V1	I_D@T_A=25°C	5.6	-4.3	A
Continuous Drain Current, V_{GS} @ 10V1	I_D@T_A=70°C	4.5	-3.5	A
Pulsed Drain Current2	I_{DM}	46	-36	A
Single Pulse Avalanche Energy3	EAS	34.5	51.2	mJ
Avalanche Current	I_{AS}	22.6	-26.6	A
Total Power Dissipation4	P_D@T_C=25°C	34.7	34.7	W
Total Power Dissipation4	P_D@T_A=25°C	2	2	W
Storage Temperature Range	T_{STG}	-55 to 150	-55 to 150	°C
Operating Junction Temperature Range	T_J	-55 to 150	-55 to 150	°C
Thermal Resistance Junction-Ambient 1	$R_{\theta JA}$	62		°C/W
Thermal Resistance Junction-Case1	$R_{\theta JC}$	3.6		°C/W

N-Ch and P-Ch Fast Switching MOSFET

V_{DS}=60V, I_D=23A, $RDS_{(ON)}$=32mΩ

V_{DS}=-60V, I_D=-18A, $RDS_{(ON)}$=70mΩ

➢ N-Channel Electrical Characteristics (TJ=25°C Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V , I_D=250uA	60	---	---	V
BV_{DSS} Temperature Coefficient	Δ BV_{DSS}/Δ T_J	Reference to 25℃ , I_D=1mA	---	0.063	---	V/℃
Static Drain-Source On-Resistance2	$R_{DS(ON)}$	V_{GS}=10V , I_D=15A	---	---	32	mΩ
		V_{GS}=4.5V , I_D=10A	---	---	38	
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS}=V_{DS} , I_D =250uA	1.2	---	2.5	V
$V_{GS(th)}$ Temperature Coefficient	Δ $V_{GS(th)}$		---	-5.24	---	mV/℃
Drain-Source Leakage Current	I_{DSS}	V_{DS}=48V , V_{GS}=0V , T_J=25℃	---	---	1	uA
		V_{DS}=48V , V_{GS}=0V , T_J=55℃	---	---	5	
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±20V , V_{DS}=0V	---	---	±100	nA
Forward Transconductance	gfs	V_{DS}=5V , I_D=15A	---	17	---	S
Gate Resistance	R_g	V_{DS}=0V , V_{GS}=0V , f=1MHz	---	3.2	---	Ω
Total Gate Charge (4.5V)	Q_g	V_{DS}=48V , V_{GS}=4.5V , I_D=12A	---	12.56	---	nC
Gate-Source Charge	Q_{gs}		---	3.24	---	
Gate-Drain Charge	Q_{gd}		---	6.31	---	
Turn-On Delay Time	$T_{d(on)}$	V_{DD}=30V , V_{GS}=10V , R_G=3.3Ω, I_D=10A	---	8	---	ns
Rise Time	T_r		---	14.2	---	
Turn-Off Delay Time	$T_{d(off)}$		---	24.4	---	
Fall Time	T_f		---	4.6	---	
Input Capacitance	C_{iss}	V_{DS}=15V , V_{GS}=0V , f=1MHz	---	1378	---	pF
Output Capacitance	C_{oss}		---	86	---	
Reverse Transfer Capacitance	C_{rss}		---	64	---	

➢ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current1,5	I_S	V_G=V_D=0V , Force Current	---	---	23	A
Pulsed Source Current2,5	I_{SM}		---	---	46	A
Diode Forward Voltage2	V_{SD}	V_{GS}=0V , I_S=1A , T_J=25℃	---	---	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 =25V,V_{GS}=10V,L=0.1mH,I_{AS}=22.6A

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.

N-Ch and P-Ch Fast Switching MOSFET

V_{DS}=60V, I_D=23A, $RDS_{(ON)}$=32mΩ

V_{DS}=-60V, I_D=-18A, $RDS_{(ON)}$=70mΩ

➢ P-Channel Electrical Characteristics (TJ=25° C Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V , I_D=-250uA	-60	---	---	V
BV_{DSS} Temperature Coefficient	Δ BV_{DSS}/Δ T_J	Reference to 25℃ , I_D=-1mA	---	-0.03	---	V/℃
Static Drain-Source On-Resistance2	$R_{DS(ON)}$	V_{GS}=-10V , I_D=-12A	---	---	70	mΩ
		V_{GS}=-4.5V , I_D=-8A	---	---	105	
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS}=V_{DS} , I_D =-250uA	-1.2	---	-2.5	V
$V_{GS(th)}$ Temperature Coefficient	Δ $V_{GS(th)}$		---	4.56	---	mV/℃
Drain-Source Leakage Current	I_{DSS}	V_{DS}=-48V , V_{GS}=0V , T_J=25℃	---	---	1	uA
		V_{DS}=-48V , V_{GS}=0V , T_J=55℃	---	---	5	
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±20V , V_{DS}=0V	---	---	±100	nA
Forward Transconductance	gfs	V_{DS}=-5V , I_D=-12A	---	15	---	S
Gate Resistance	R_g	V_{DS}=0V , V_{GS}=0V , f=1MHz	---	13.5	---	Ω
Total Gate Charge (-4.5V)	Q_g	V_{DS}=-48V , V_{GS}=-4.5V , I_D=-12A	---	9.86	---	nC
Gate-Source Charge	Q_{gs}		---	3.08	---	
Gate-Drain Charge	Q_{gd}		---	2.95	---	
Turn-On Delay Time	$T_{d(on)}$	V_{DD}=-15V , V_{GS}=-10V , R_G=3.3Ω, I_D=-1A	---	28.8	---	ns
Rise Time	T_r		---	19.8	---	
Turn-Off Delay Time	$T_{d(off)}$		---	60.8	---	
Fall Time	T_f		---	7.2	---	
Input Capacitance	C_{iss}	V_{DS}=-15V , V_{GS}=0V , f=1MHz	---	1447	---	pF
Output Capacitance	C_{oss}		---	97	---	
Reverse Transfer Capacitance	C_{rss}		---	70	---	

➢ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current1,5	I_S	V_G=V_D=0V , Force Current	---	---	-18	A
Pulsed Source Current2,5	I_{SM}		---	---	-36	A
Diode Forward Voltage2	V_{SD}	V_{GS}=0V , I_S=-1A , T_J=25℃	---	---	-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}=-26.6A

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.

N-Ch and P-Ch Fast Switching MOSFET

V_{DS}=60V, I_D=23A, $RDS_{(ON)}$=32mΩ

V_{DS}=-60V, I_D=-18A, $RDS_{(ON)}$=70mΩ

➢ N-Channel Typical Characteristics

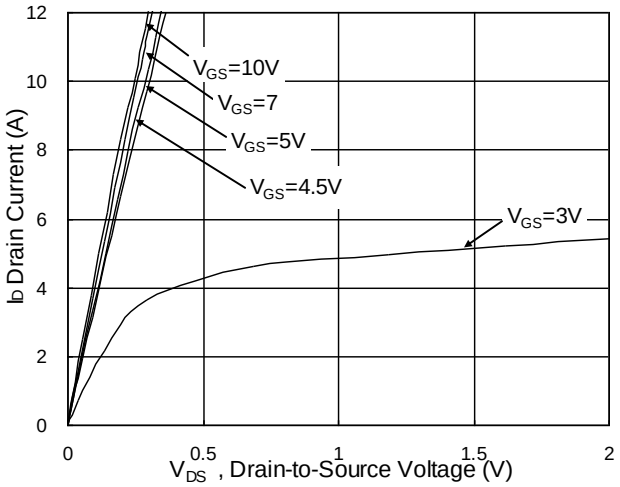


Fig.1 Typical Output Characteristics

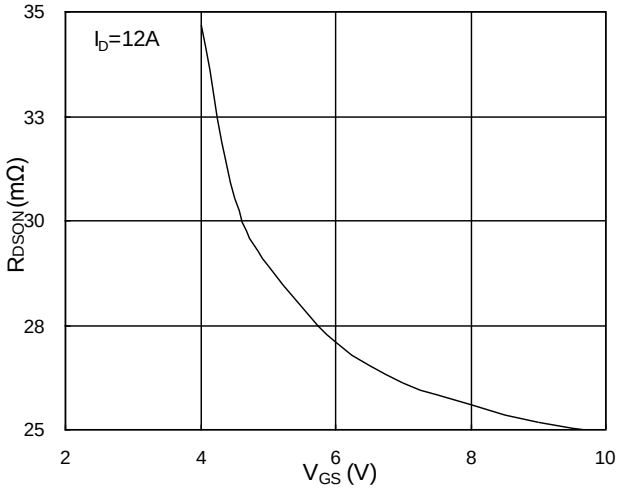


Fig.2 On-Resistance v.s Gate-Source

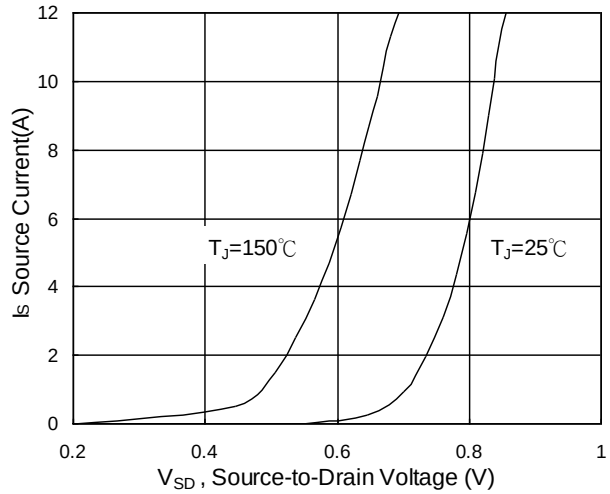


Fig.3 Forward Characteristics of Reverse

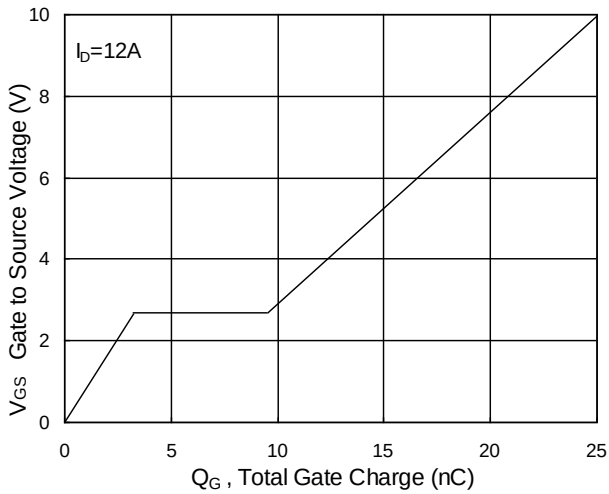


Fig.4 Gate-Charge Characteristics

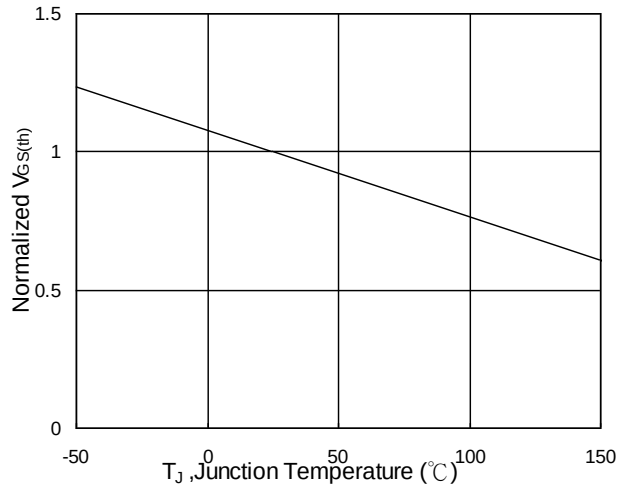


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

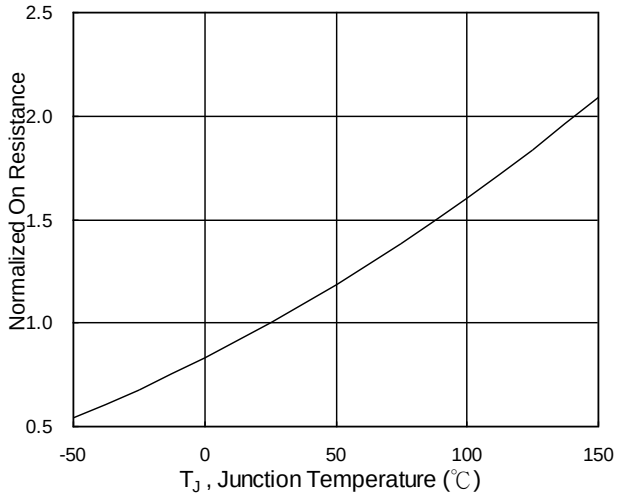


Fig.6 Normalized R_{DSON} v.s T_J

N-Ch and P-Ch Fast Switching MOSFET

V_{DS}=60V, I_D=23A, $RDS_{(ON)}$=32mΩ

V_{DS}=-60V, I_D=-18A, $RDS_{(ON)}$=70mΩ

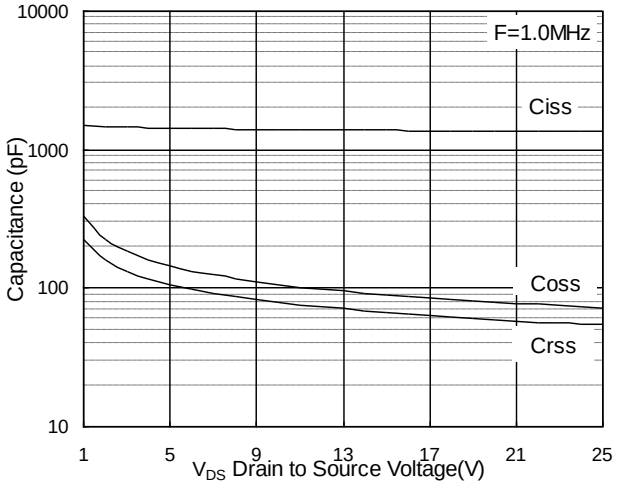


Fig.7 Capacitance

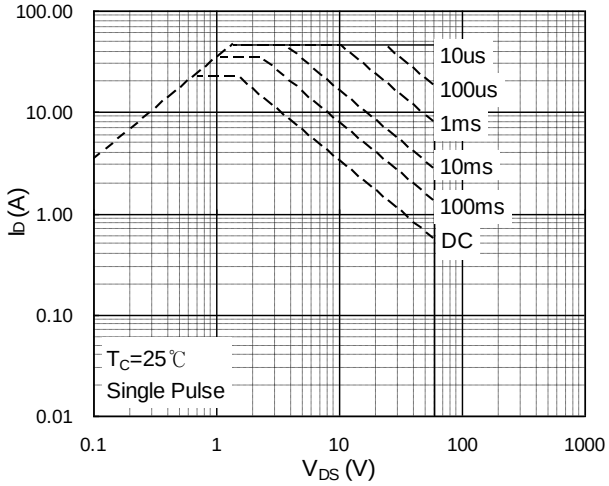


Fig.8 Safe Operating Area

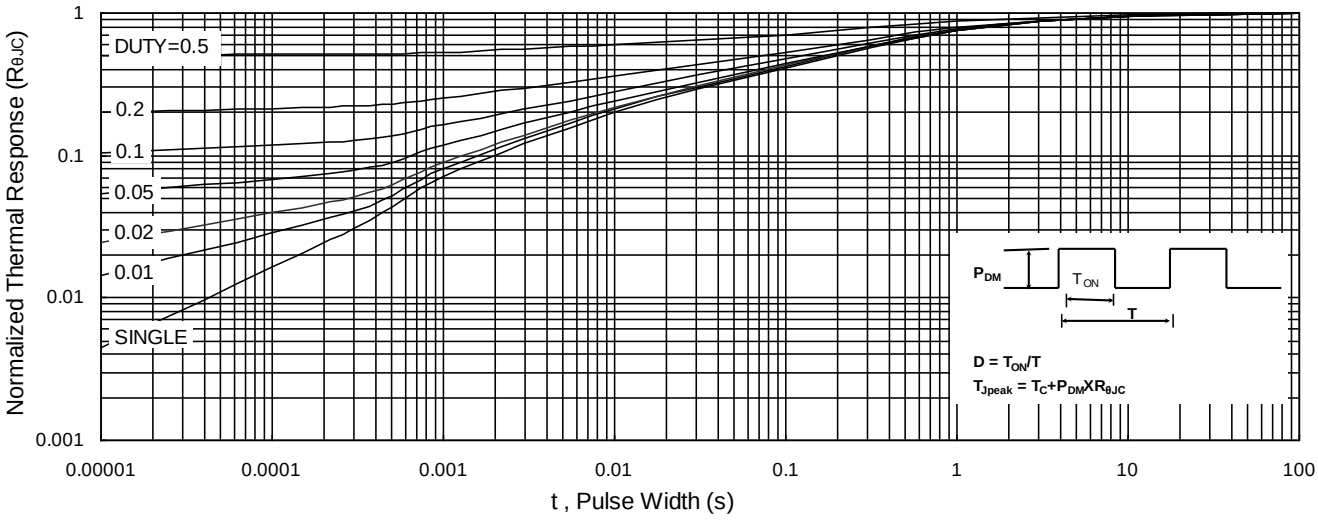


Fig.9 Normalized Maximum Transient Thermal Impedance

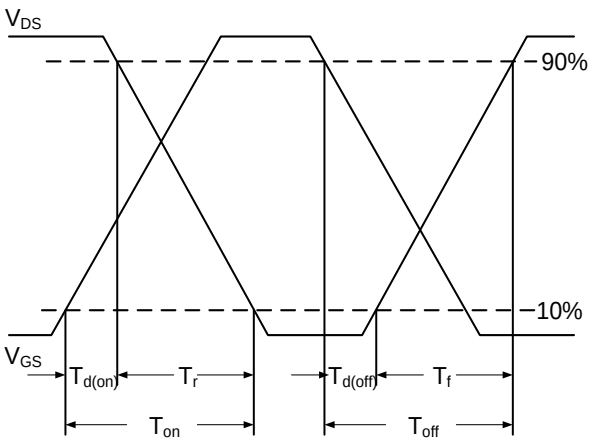


Fig.10 Switching Time Waveform

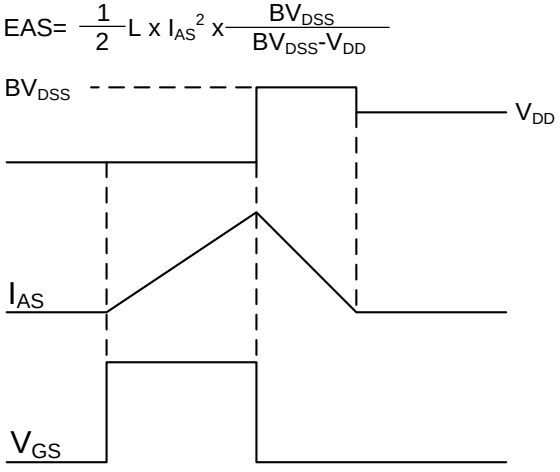


Fig.11 Unclamped Inductive Waveform

N-Ch and P-Ch Fast Switching MOSFET

V_{DS}=60V, I_D=23A, $RDS_{(ON)}$=32mΩ

V_{DS}=-60V, I_D=-18A, $RDS_{(ON)}$=70mΩ

➢ P-Channel Typical Characteristics

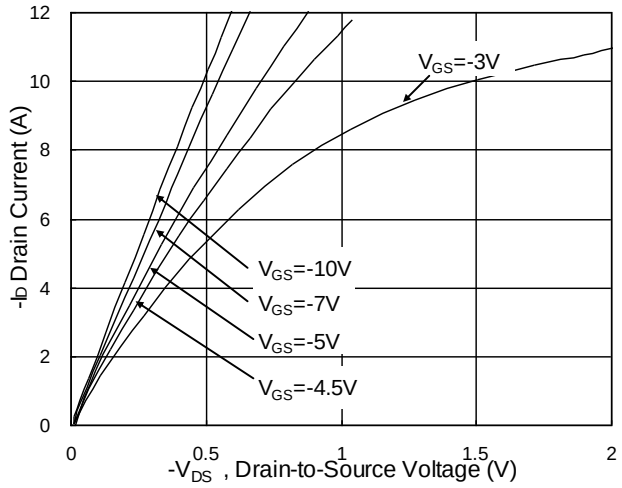


Fig.1 Typical Output Characteristics

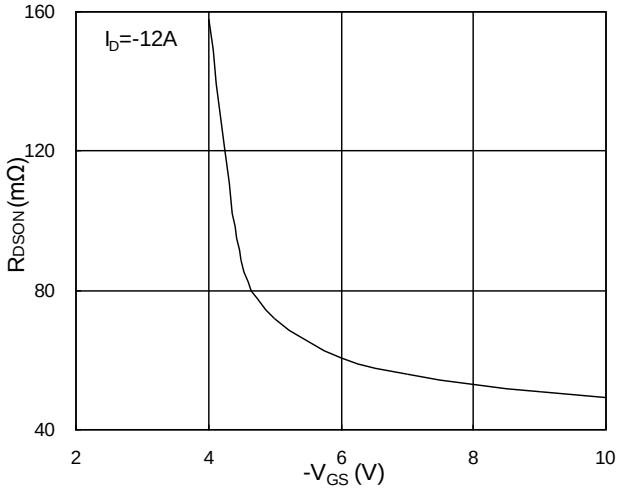


Fig.2 On-Resistance v.s Gate-Source

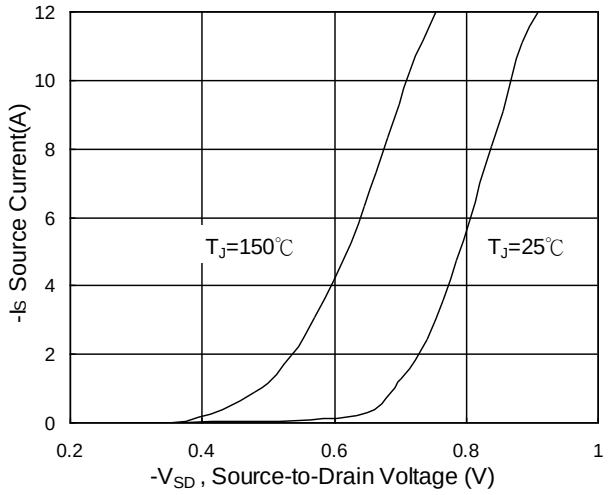


Fig.3 Forward Characteristics of Reverse

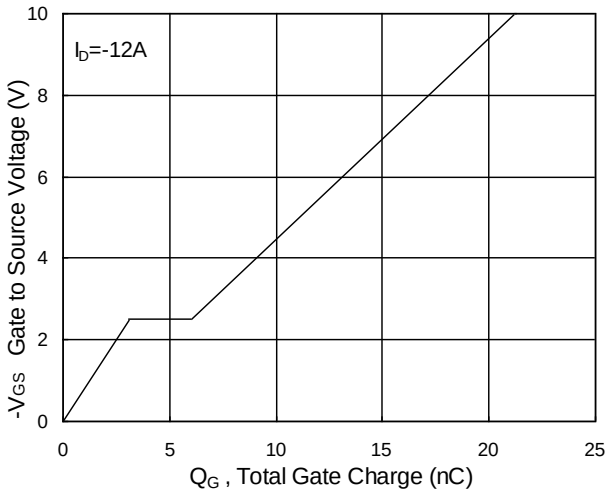


Fig.4 Gate-Charge Characteristics

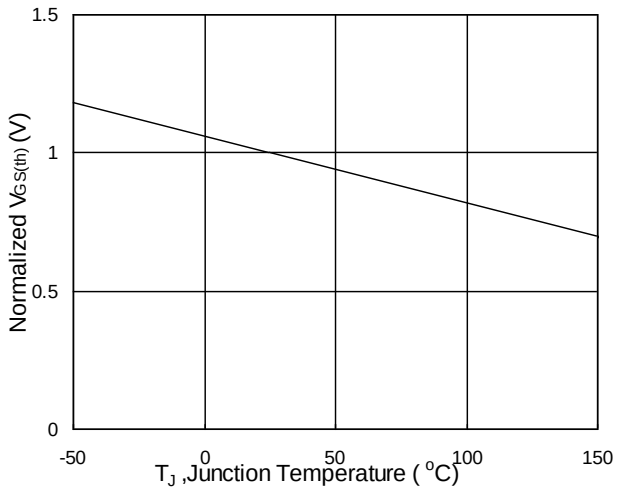


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

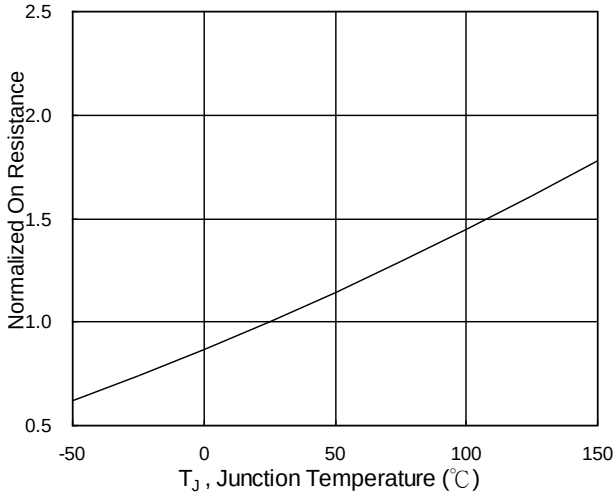


Fig.6 Normalized R_{DSON} v.s T_J

N-Ch and P-Ch Fast Switching MOSFET

V_{DS}=60V, I_D=23A, $RDS_{(ON)}$=32mΩ

V_{DS}=-60V, I_D=-18A, $RDS_{(ON)}$=70mΩ

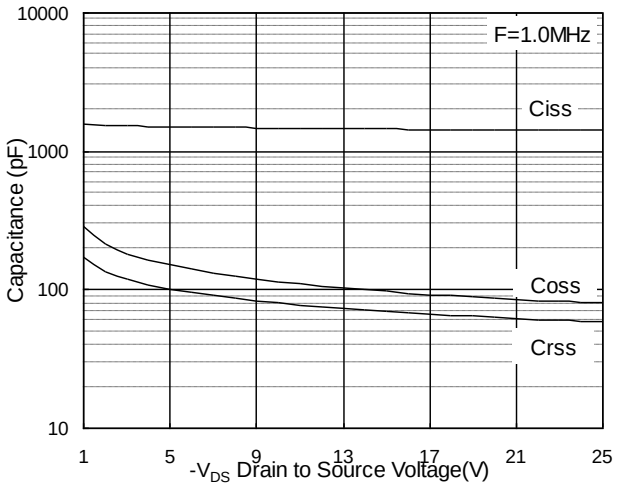


Fig.7 Capacitance

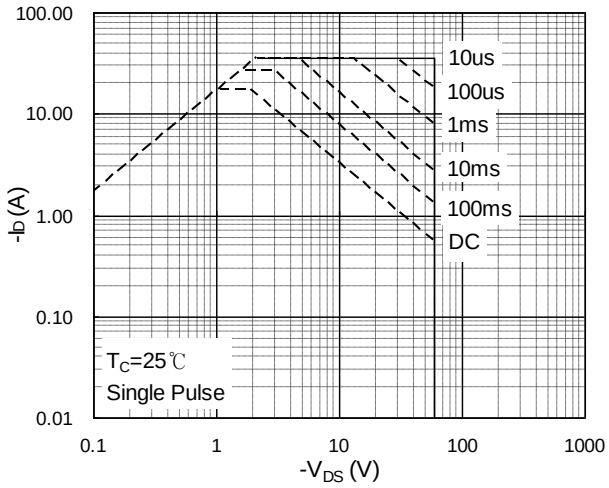


Fig.8 Safe Operating Area

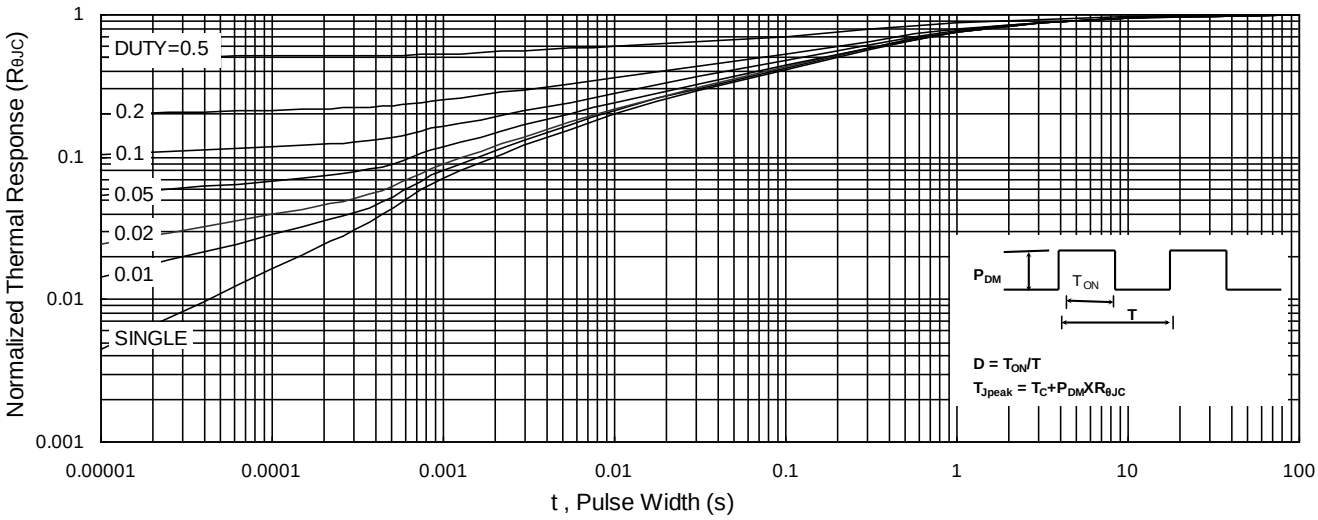


Fig.9 Normalized Maximum Transient Thermal Impedance

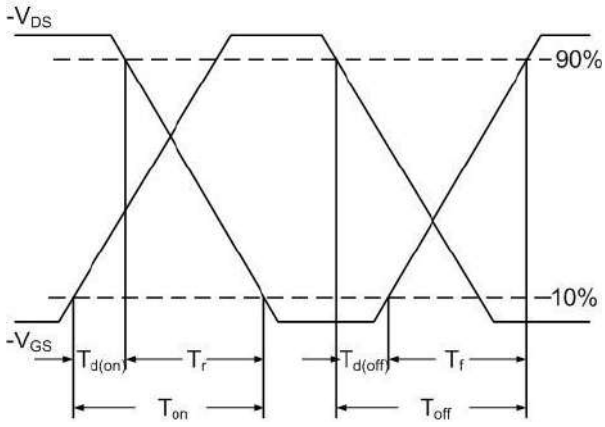


Fig.10 Switching Time Waveform

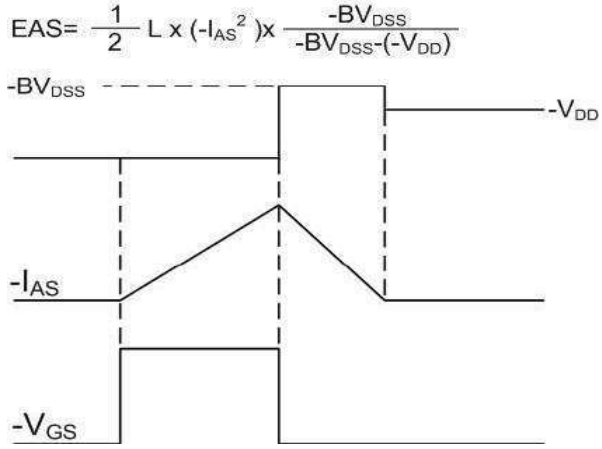
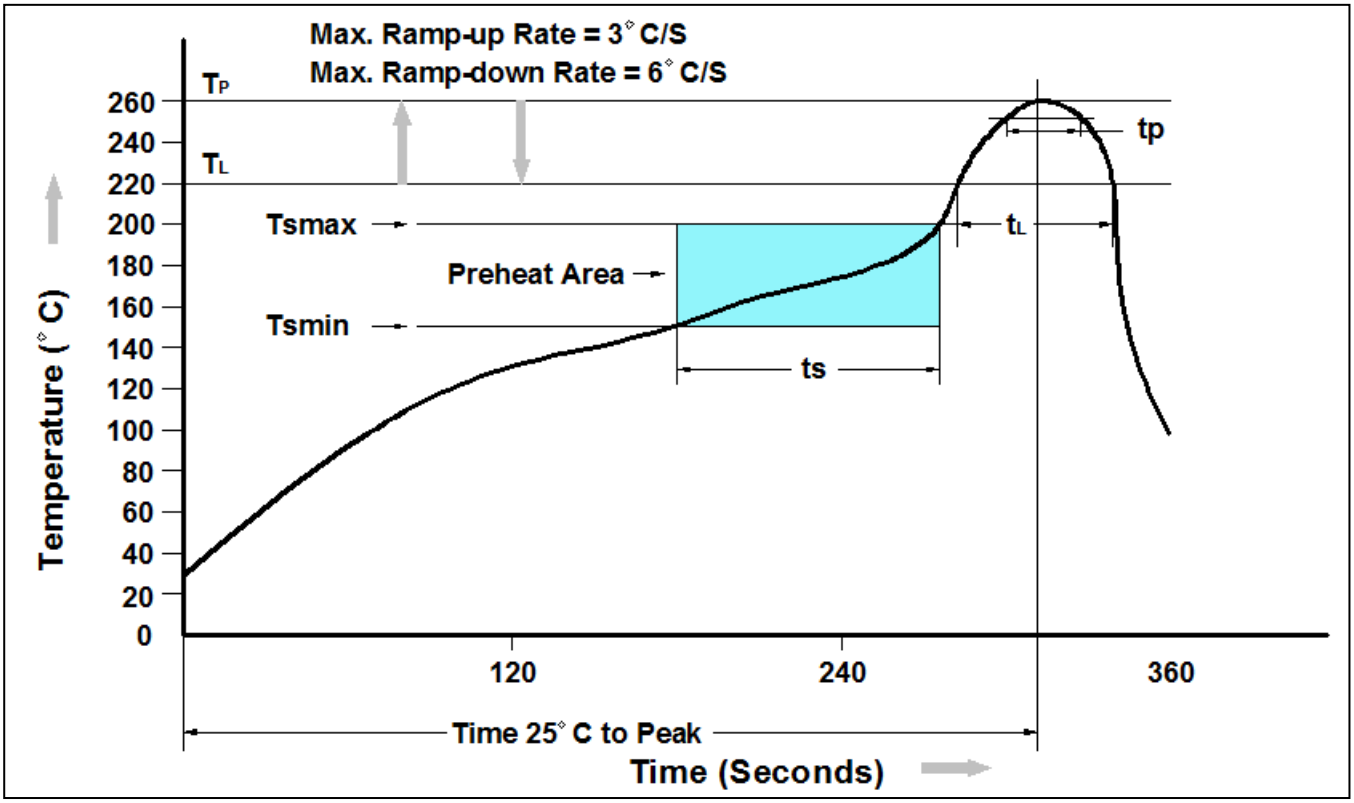


Fig.11 Unclamped Inductive Waveform

➢ Recommand IR Reflow Soldering Thermal Profile

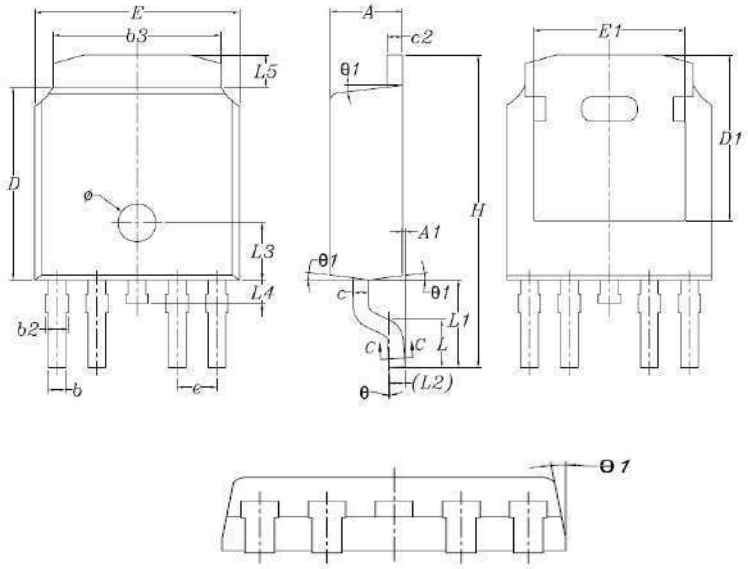


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (ts) from (Tsmin to Tsmax)	60-120 seconds
Average Ramp-up Rate (tL to tP)	3°C/second max.
Liquidous Temperature (TL)	217°C
Time (tL) Maintained Above (TL)	60 – 150 seconds
Peak Temperature	260°C +0°C / -5°C
Time (tP) within 5°C of actual Peak Temperature	30 seconds
Ramp-down Rate (TP to TL)	6°C/second max
Time 25°C to Peak Temperature	8 minutes max.

➢ Ordering Information

Part Number	Description	Quantity
PAC69TX01X	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
Θ	0°	10°	0°	10°
Θ1	0°	15°	0°	15°
Ø	1.050	1.350	0.0413	0.0531

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- Though Paceleader make effort to improve product quality and reliability, Product can malfunction and fail due to their inherent electrical sensitivity and vulnerability to physical stress, it is the responsibility of the customer, when utilizing Paceleader products, to comply with the standards of safety in making a safe design for entire system and to avoid situation in which a malfunction or failure., In developing a new designs, customer should ensure that the device which shown in this documents are used within specified operating ranges.

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