# TM4614A

## N+P-Channel Enhancement Mode Mosfet

### General Description

- Low $R_{DS(ON)}$
- RoHS and Halogen-Free Compliant

### Applications

- Load switch
- PWM

### General Features

**N Channel**

$V_{DS}$ = 40V,$I_D$=9.8A

$R_{DS(ON)}$=16mΩ (typ.) @ $V_{GS}$=10V

**P Channel**

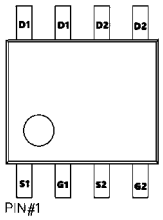
$V_{DS}$ = -40V,$I_D$=-7.5A

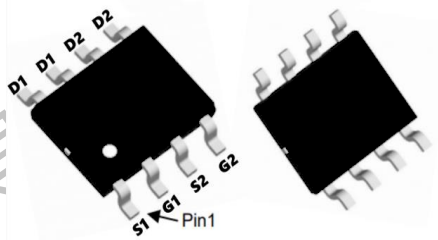
$R_{DS(ON)}$=35mΩ (typ.) @ $V_{GS}$=-10V

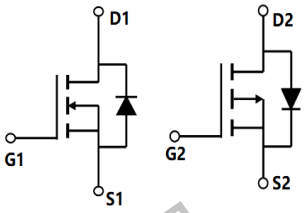
100% UIS Tested

100% $R_g$ Tested

S:SOP-8L




Marking: 4614A

### Absolute Maximum Ratings ($T_A$=25℃ unless otherwise noted)

| Symbol | Parameter | Rating | | Units |
|---|---|---|---|---|
| | | N-Channel | P-Channel | |
| $V_{DS}$ | Drain-Source Voltage | 40 | -40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | ±20 | V |
| $I_D$@$T_A$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 9.8 | -7.5 | A |
| $I_D$@$T_A$=70℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 6.5 | -5.8 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 28 | -24 | A |
| EAS | Single Pulse Avalanche Energy[3] | 16.2 | 39 | mJ |
| $I_{AS}$ | Avalanche Current | 22 | -28 | A |
| $P_D$@$T_A$=25℃ | Total Power Dissipation[4] | 1.67 | 1.67 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 175 | -55 to 175 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 175 | -55 to 175 | ℃ |

### Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | --- | 85 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 62.5 | ℃/W |

# TM4614A

## N+P-Channel Enhancement Mode Mosfet

### N-Channel Electrical Characteristics ($T_J$=25℃ , unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BVDSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 40 | --- | --- | V |
| △BVDSS/△TJ | BVDSS Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.034 | --- | V/℃ |
| RDS(ON) | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=5A | --- | 16 | 18 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=4A | --- | 19 | 25 | |
| VGS(th) | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.2 | 1.6 | 2.0 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4.56 | --- | mV/℃ |
| IDSS | Drain-Source Leakage Current | $V_{DS}$=32V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=32V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 | |
| IGSS | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=5A | --- | 14 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 2.6 | --- | Ω |
| $Q_g$ | Total Gate Charge (4.5V) | $V_{DS}$=20V , $V_{GS}$=4.5V , $I_D$=5A | --- | 5.5 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 1.25 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 2.5 | --- | |
| Td(on) | Turn-On Delay Time | $V_{DD}$=20V , $V_{GS}$=10V , $R_G$=3.3Ω $I_D$=1A | --- | 8.9 | --- | ns |
| $T_r$ | Rise Time | | --- | 2.2 | --- | |
| Td(off) | Turn-Off Delay Time | | --- | 41 | --- | |
| $T_f$ | Fall Time | | --- | 2.7 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , f=1MHz | --- | 593 | --- | pF |
| Coss | Output Capacitance | | --- | 76 | --- | |
| Crss | Reverse Transfer Capacitance | | --- | 56 | --- | |
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | 9.8 | A |
| ISM | Pulsed Source Current[2,5] | | --- | --- | 23 | A |
| VSD | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1.2 | V |

**Note :**

1、The data tested by surface mounted on a 1 inch2 FR-4 board with 2OZ copper.
2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%
3、The EAS data shows Max. rating . The test condition is VDD=25V,VGS=10V,L=0.1mH,IAS=17.8A
4、The power dissipation is limited by 150℃ junction temperature
5、The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation

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## N+P-Channel Enhancement Mode Mosfet

### P-Channel Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BVDSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -40 | --- | --- | V |
| △BVDSS/△TJ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.02 | --- | V/℃ |
| RDS(ON) | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V , $I_D$=-6A | --- | 35 | 39 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-3A | --- | 40 | 47 | |
| VGS(th) | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.0 | -1.75 | -2.5 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 3.72 | --- | mV/℃ |
| IDSS | Drain-Source Leakage Current | $V_{DS}$=-32V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=-32V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 | |
| IGSS | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=-5V , $I_D$=-6A | --- | 13 | --- | S |
| $Q_g$ | Total Gate Charge (-4.5V) | $V_{DS}$=-20V , $V_{GS}$=-4.5V , $I_D$=-6A | --- | 11.5 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 3.5 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 3.3 | --- | |
| Td(on) | Turn-On Delay Time | $V_{DD}$=-15V , $V_{GS}$=-10V , $R_G$=3.3Ω, $I_D$=-1A | --- | 22 | --- | ns |
| $T_r$ | Rise Time | | --- | 15.7 | --- | |
| Td(off) | Turn-Off Delay Time | | --- | 59 | --- | |
| $T_f$ | Fall Time | | --- | 5.5 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , f=1MHz | --- | 1215 | --- | pF |
| Coss | Output Capacitance | | --- | 134 | --- | |
| Crss | Reverse Transfer Capacitance | | --- | 102 | --- | |
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | -7.5 | A |
| ISM | Pulsed Source Current[2,5] | | --- | --- | -22 | A |
| VSD | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1.2 | V |

**Note :**

1、The data tested by surface mounted on a 1 inch2 FR-4 board with 2OZ copper.

2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3、The EAS data shows Max. rating . The test condition is VDD=-25V,VGS=-10V,L=0.1mH,IAS=-27.2A

4、The power dissipation is limited by 150℃ junction temperature

5、The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.

# TM4614A

## N+P-Channel Enhancement Mode Mosfet

### N-Channel Typical Characteristics

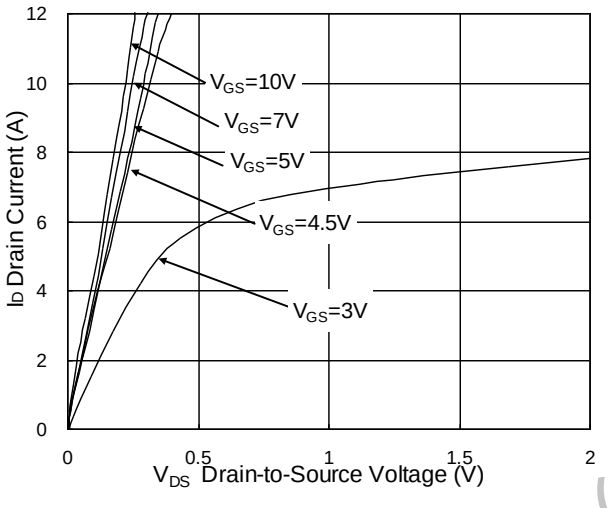



Fig.1 Typical Output Characteristics

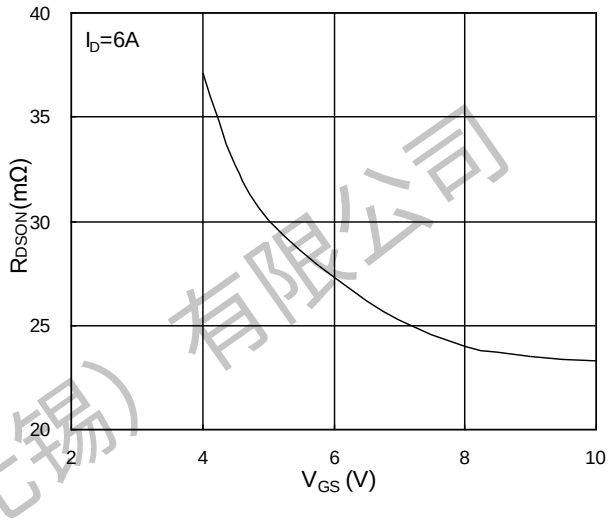



Fig.2 On-Resistance vs. G-S Voltage

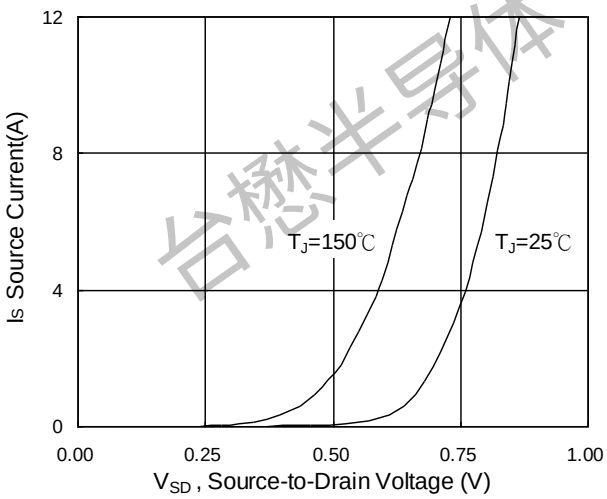



Fig.3 Source Drain Forward Characteristics

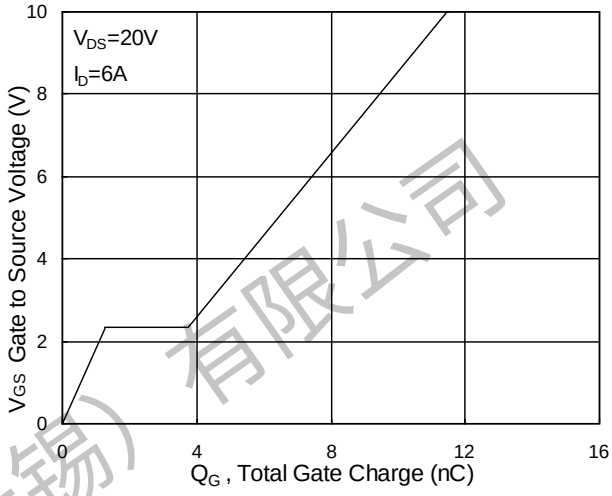



Fig.4 Gate-Charge Characteristics

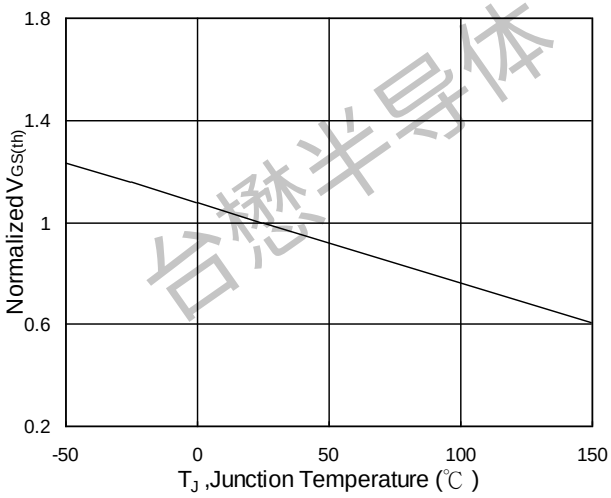



Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$

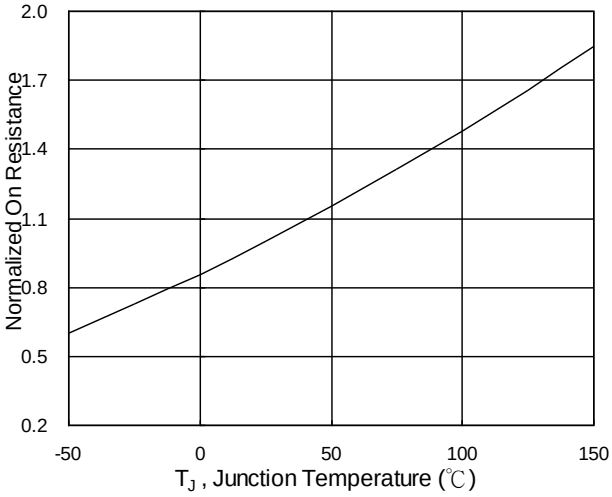



Fig.6 Normalized $R_{DSON}$ vs. $T_J$

# TM4614A

## N+P-Channel Enhancement Mode Mosfet

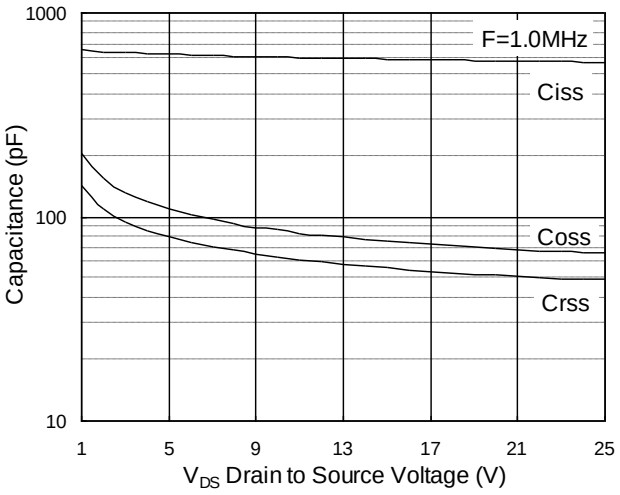



**Fig.7 Capacitance**

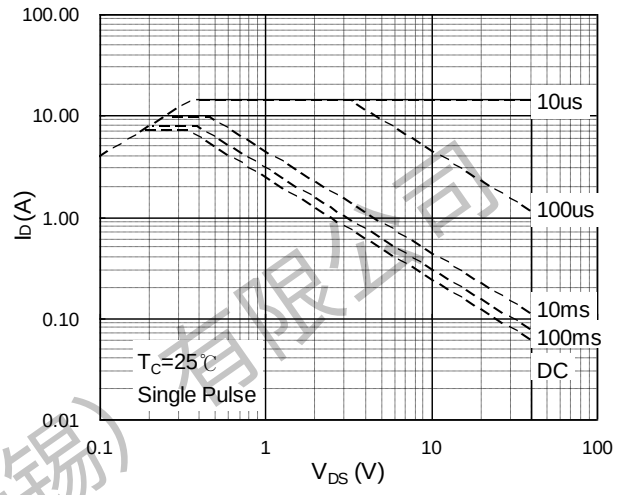



**Fig.8 Safe Operating Area**

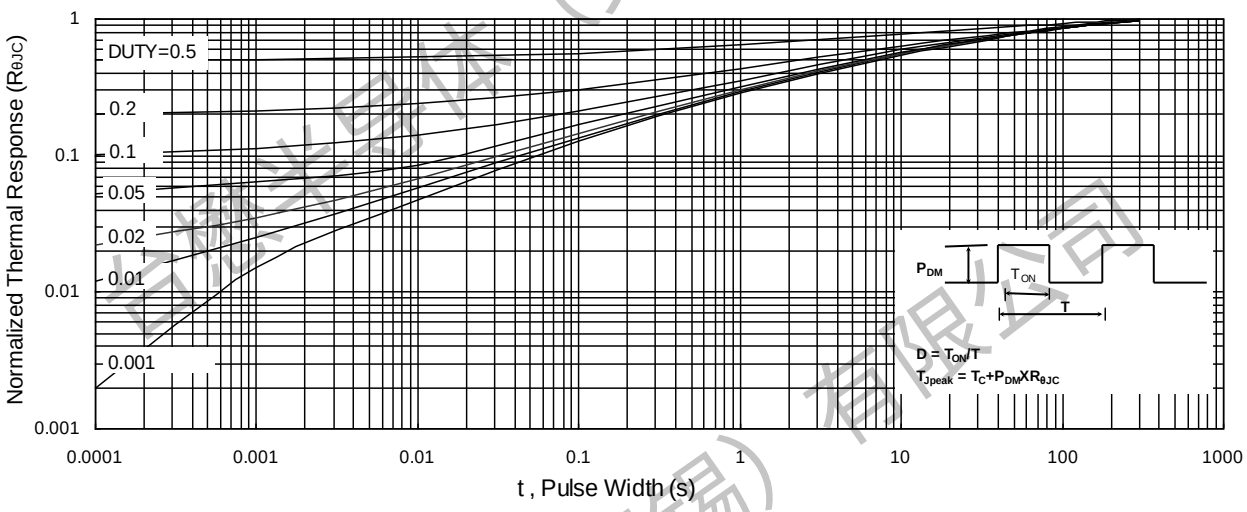



**Fig.9 Normalized Maximum Transient Thermal Impedance**

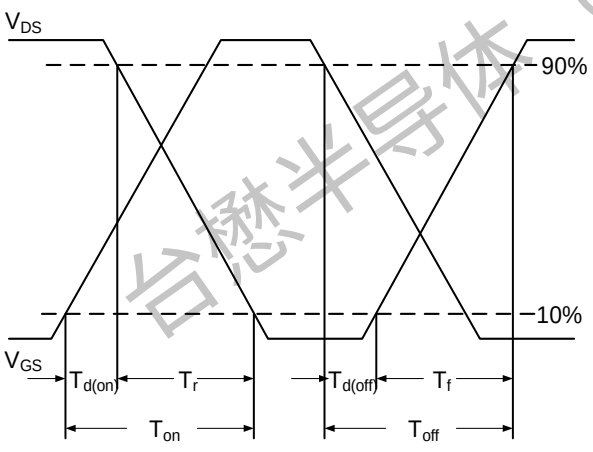



**Fig.10 Switching Time Waveform**

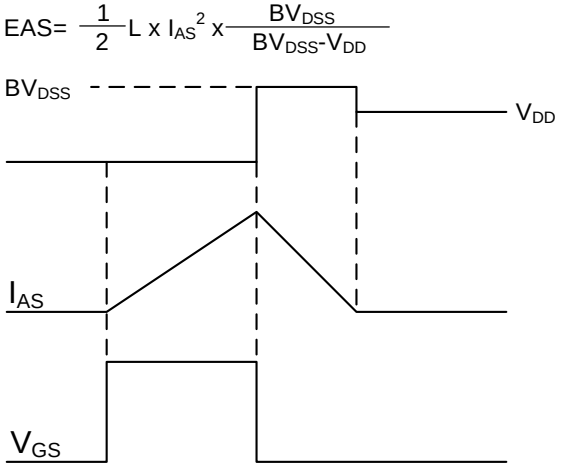



**Fig.11 Unclamped Inductive Waveform**

# TM4614A

## N+P-Channel Enhancement Mode Mosfet

### P-Channel Typical Characteristics

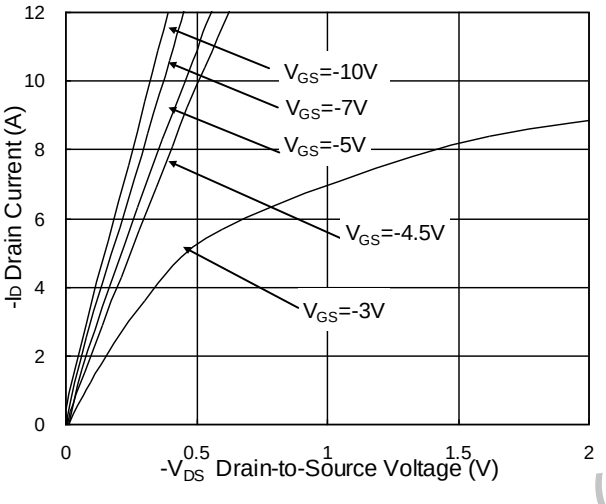



Fig.1 Typical Output Characteristics

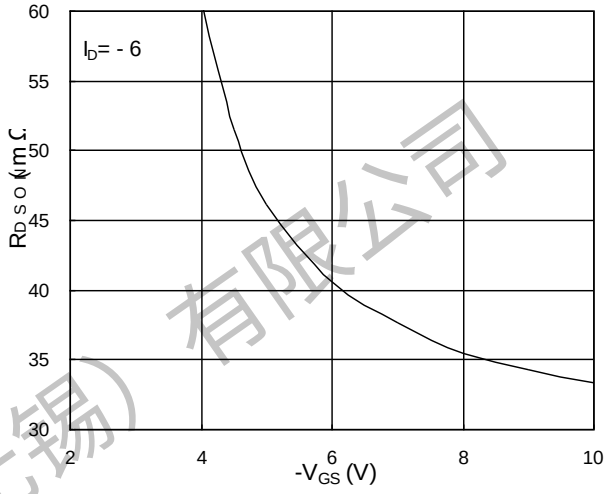



Fig.2 On-Resistance vs. G-S Voltage

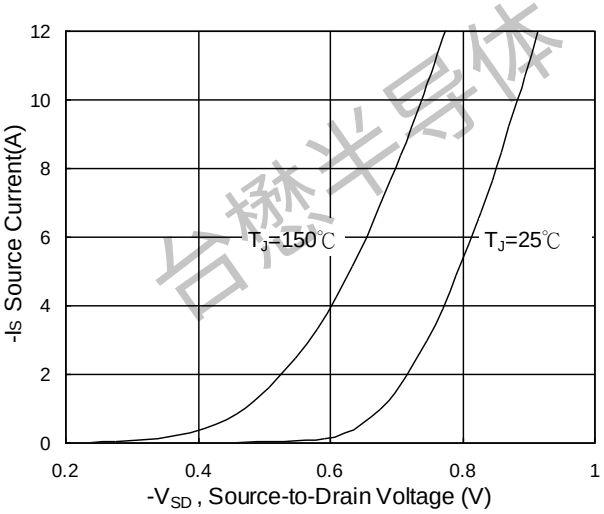



Fig.3 Source Drain Forward Characteristics

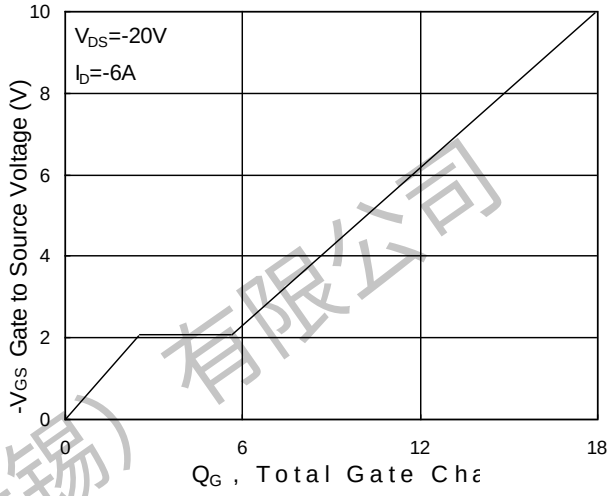



Fig.4 Gate-Charge Characteristics

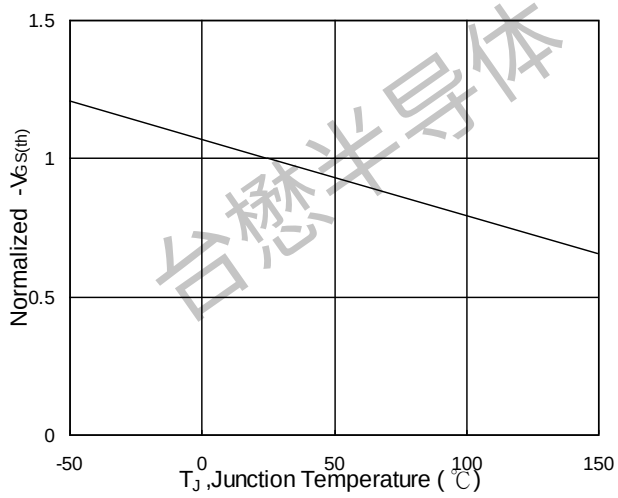



Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$

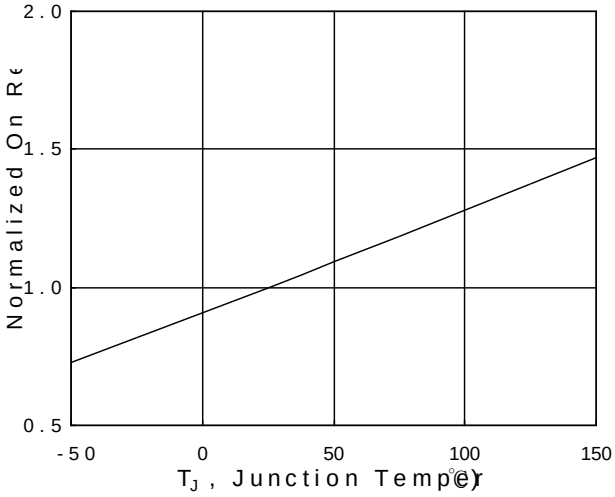



Fig.6 Normalized $R_{DSON}$ vs. $T_J$

# TM4614A

## N+P-Channel Enhancement Mode Mosfet

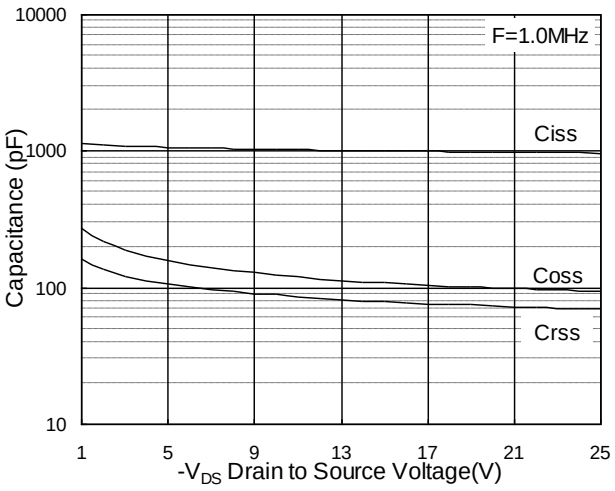



Fig.7 Capacitance

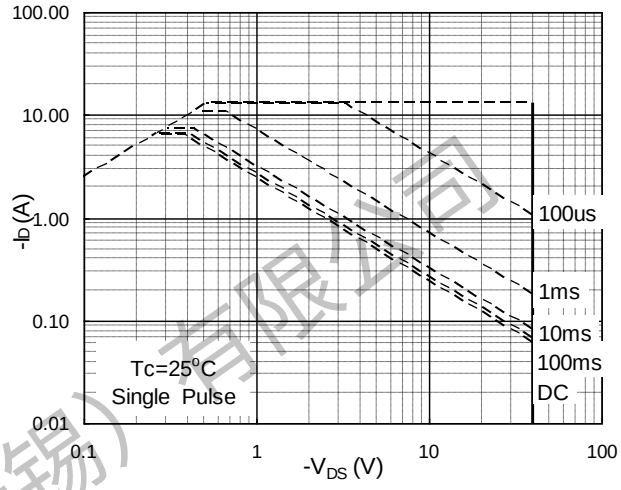



Fig.8 Safe Operating Area

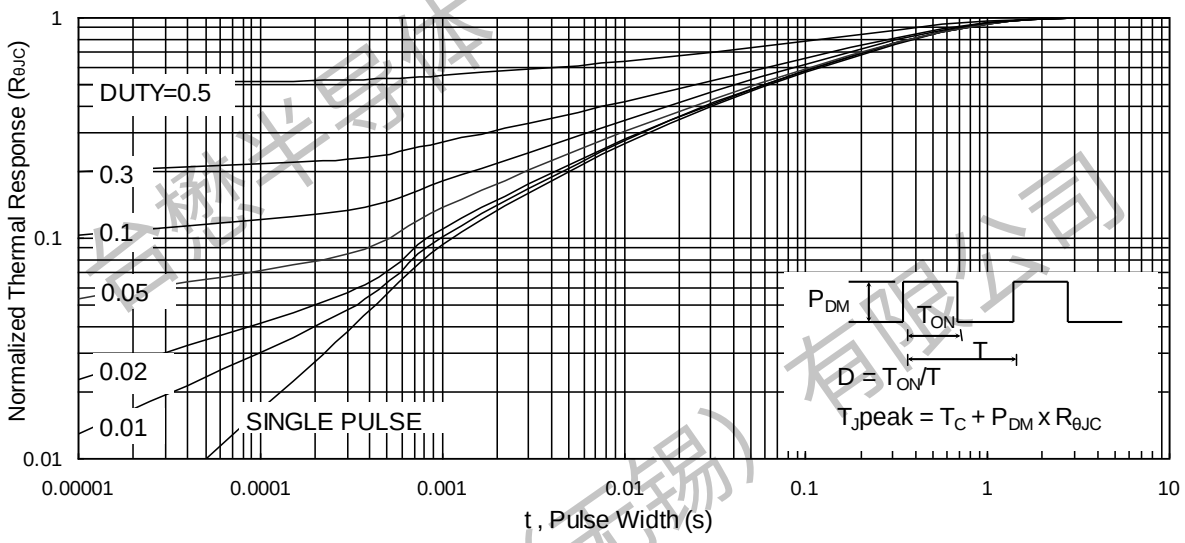



Fig.9 Normalized Maximum Transient Thermal Impedance

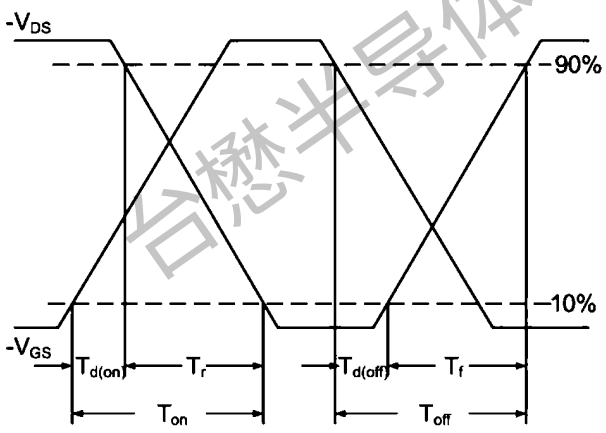



Fig.10 Switching Time Waveform

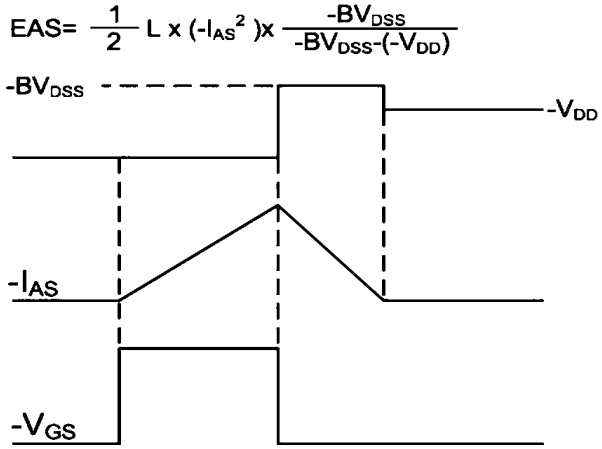
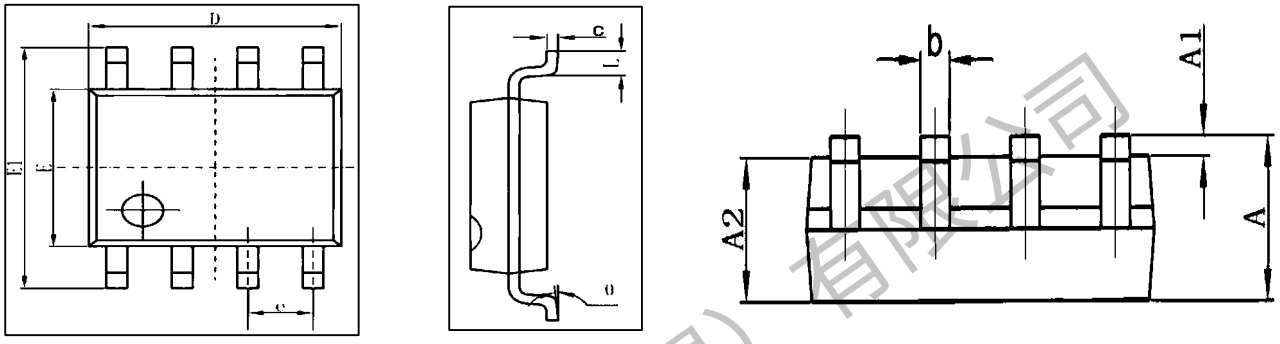



Fig.11 Unclamped Inductive Waveform

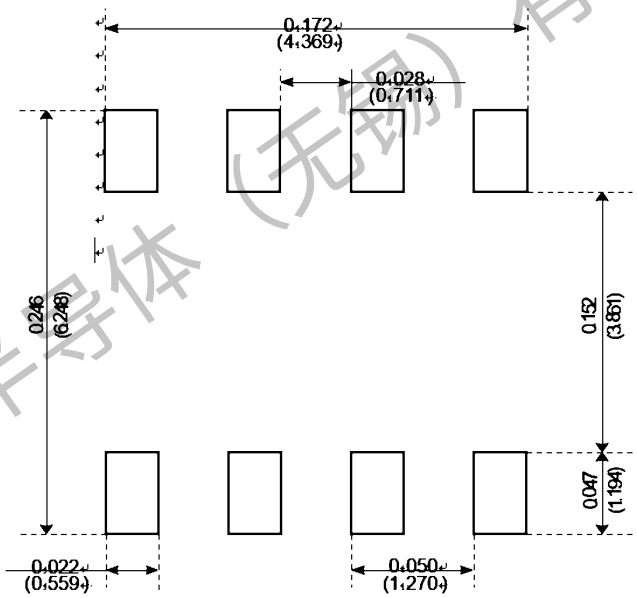
# TM4614A

N+P-Channel Enhancement Mode Mosfet

## Package Mechanical Data:SOP-8L




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270 (BSC) | | 0.050 (BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

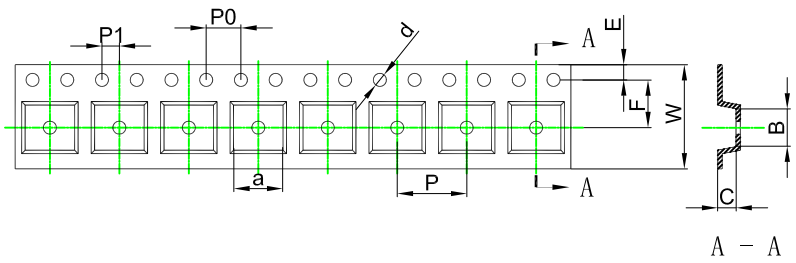



Recommended Minimum Pads

# TM4614A

## N+P-Channel Enhancement Mode Mosfet

## SOP-8L Embossed Carrier Tape



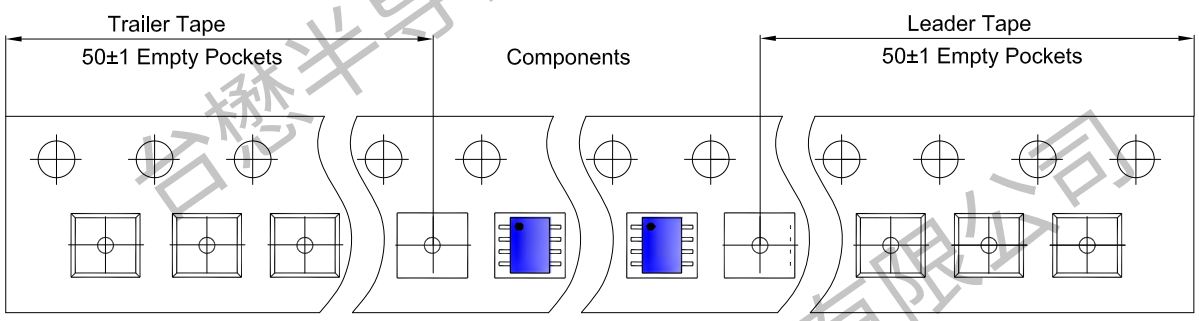

Packaging Description:

SOP-8L parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 2,500 units per 13" or 33cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

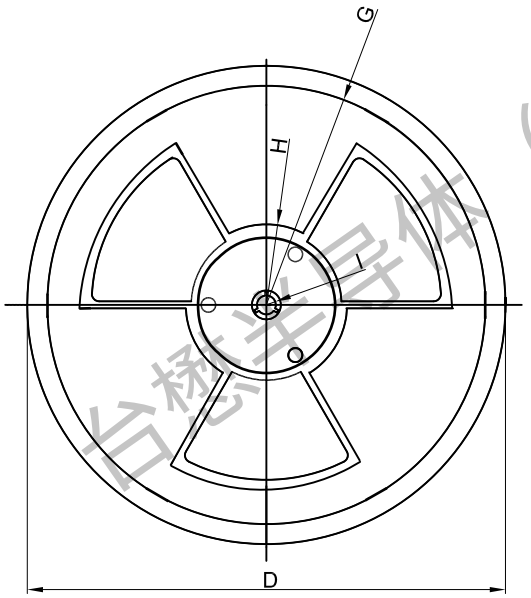
ALL DIM IN mm

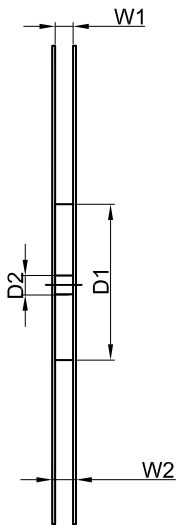
| Dimensions are in millimeter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Pkg type | a | B | C | d | E | F | P0 | P | P1 | W |
| SOP-8L | 6.40 | 5.40 | 2.10 | Ø1.50 | 1.75 | 5.50 | 4.00 | 8.00 | 2.00 | 12.00 |

## SOP-8L Tape Leader and Trailer




## SOP-8L Reel




| Dimensions are in millimeter | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reel Option | D | D1 | D2 | G | H | I | W1 | W2 |
| 13"Dia | Ø330.00 | 100.00 | 13.00 | R135.00 | R55.00 | R6.50 | 12.00 | 14.00 |

| REEL | Reel Size | Box | Box Size(mm) | Carton | Carton Size(mm) | G.W.(kg) |
|---|---|---|---|---|---|---|
| 3,000 pcs | 13 inch | 6,000 pcs | 370×355×52 | 48,000 pcs | 400×360×368 | |

## Important Notices and Disclaimers

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Revision history:

| Date | Rev | Description | Page |
|---|---|---|---|
| 2024.05.14 | 24.05 | Original | |