| | | |
|---|---|---|
| $V_{DSS}$ | -30 | V |
| $I_D$ | -6.5 | A |
| $R_{DS(ON)}$ | 30 | mΩ |

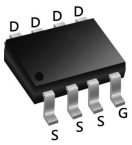
## General Description

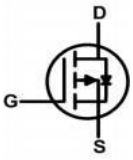
*These P-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.*

## Features

*Notebook*
*Load Switch*
*Battery Protection*
*Hand-held Instruments*

GK xxx
AO4459




# MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings Tc=25℃ unless otherwise noted

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | -30 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$ | Drain Current – Continuous ($T_C$=25˚C) | -6.5 | A |
| | Drain Current – Continuous ($T_C$=100˚C) | -5.5 | A |
| $I_{DM}$ | Drain Current – Pulsed[1] | -30 | A |
| $P_D$ | Power Dissipation ($T_C$=25˚C) | 2.1 | W |
| | Power Dissipation – Derate above 25˚C | 0.017 | W/˚C |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ˚C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ˚C |

### Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 60 | ˚C/W |

# Electrical Characteristics ($T_J$=25℃ unless otherwise specified)

## Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -30 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.03 | --- | V/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-30V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | -1 | uA |
| | | $V_{DS}$=-24V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | -10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |

## On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V , $I_D$=-6A | --- | 30 | 45 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-5A | --- | 50 | 70 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.0 | -1.6 | -2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 4 | --- | mV/℃ |
| gfs | Forward Transconductance | $V_{DS}$=-10V , $I_D$=-3A | --- | 3.5 | --- | S |

## Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[2,3] | $V_{DS}$=-15V , $V_{GS}$=-4.5V , $I_D$=-3A | --- | 5.1 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge[2,3] | | --- | 2 | --- | |
| $Q_{gd}$ | Gate-Drain Charge[2,3] | | --- | 2.2 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time[2,3] | $V_{DD}$=-15V , $V_{GS}$=-10V , $R_G$=6Ω $I_D$=-1A | --- | 3.4 | --- | ns |
| $T_r$ | Rise Time[2,3] | | --- | 10.8 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time[2,3] | | --- | 26.9 | --- | |
| $T_f$ | Fall Time[2,3] | | --- | 6.9 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-10V , $V_{GS}$=0V , F=1MHz | --- | 1400 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 300 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 230 | --- | |

## Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V , Force Current | --- | --- | -6.5 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | -13 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1.2 | V |

## RATING AND CHARACTERISTIC CURVES

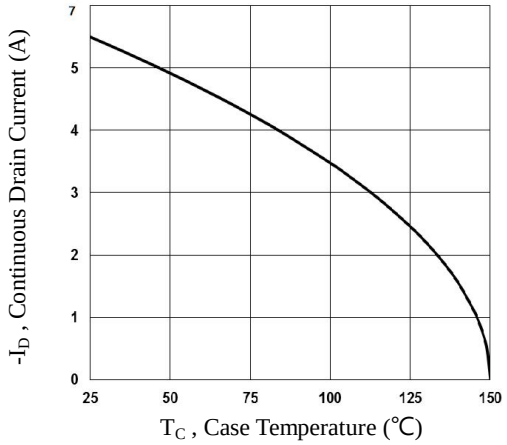



**Fig.1 Continuous Drain Current vs. $T_C$**

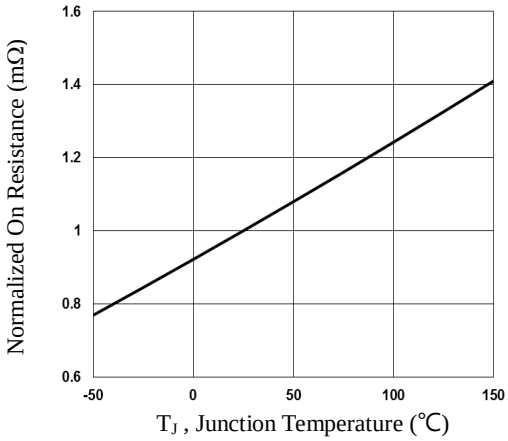



**Fig.2 Normalized RDSON vs. $T_J$**

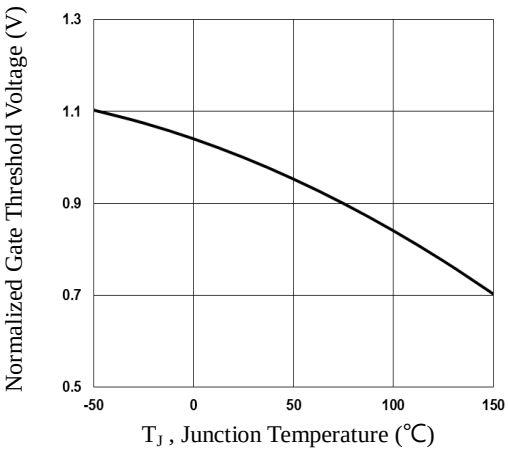



**Fig.3 Normalized $V_{th}$ vs. $T_J$**

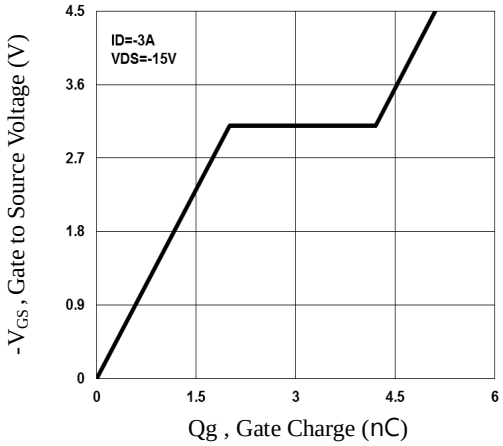



**Fig.4 Gate Charge Waveform**

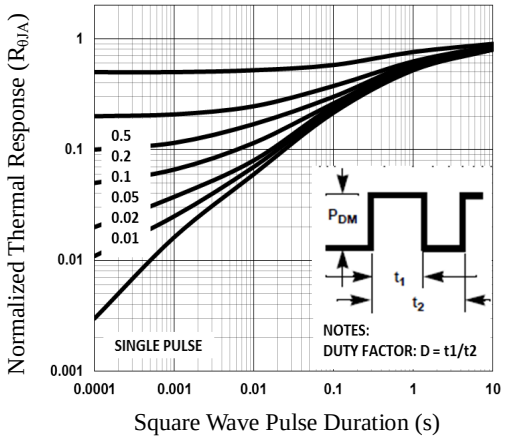



**Fig.5 Normalized Transient Impedance**

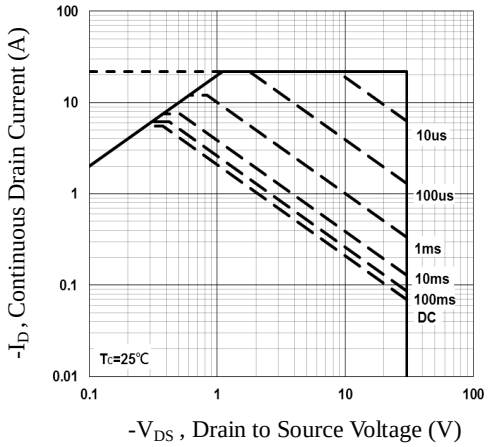
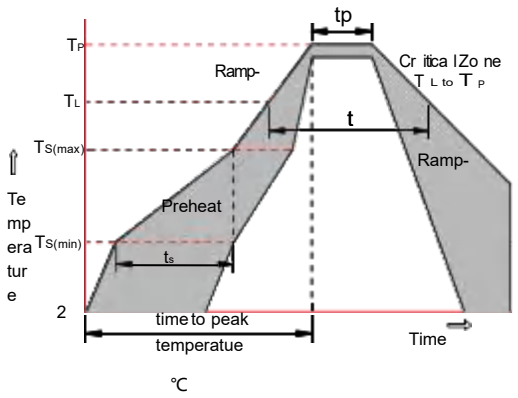



**Fig.6 Maximum Safe Operation Area**

## Soldering parameters

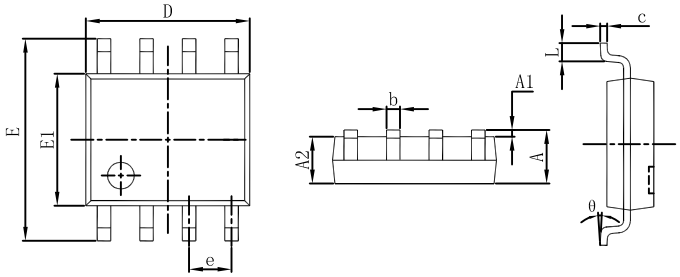
| Reflow Condition | | Pb-Free assembly (see as bellow) |
|---|---|---|
| Pre Heat | -Temperature Min ($T_{s(min)}$) | +150℃ |
| | -Temperature Max($T_{s(max)}$) | +200℃ |
| | -Time (Min to Max) (ts) | 60-180 secs. |
| Average ramp up rate (Liquid us Temp ($T_L$) to peak) | | 3℃/sec. Max |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate | | 3℃/sec. Max |
| Reflow | -Temperature($T_L$)(Liquid us) | +217℃ |
| | -Temperature($t_L$) | 60-150 secs. |
| Peak Temp ($T_p$) | | +260(+0/-5)℃ |
| Time within 5℃ of actual Peak Temp ($t_p$) | | 30 secs. Max |
| Ramp-down Rate | | 6℃/sec. Max |
| Time 25℃ to Peak Temp ($T_P$) | | 8 min. Max |
| Do not exceed | | +260℃ |

**FIG5:** Reflow condition

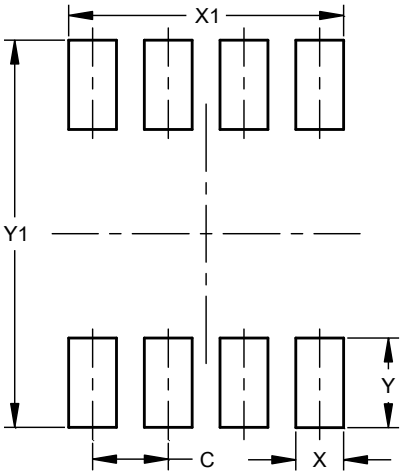



## Package Dimensions & Suggested Pad Layout

**SOP-8**



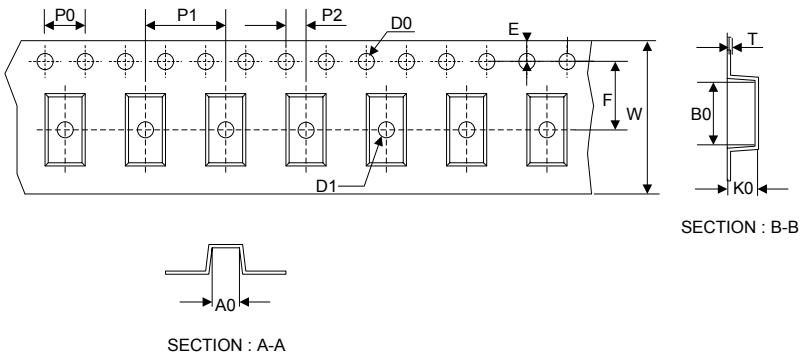

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | **Min** | **Max** | **Min** | **Max** |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.007 | 0.010 |
| D | 4.800 | 5.000 | 0.189 | 0.197 |
| e | 1.270 (BSC) | | 0.050 (BSC) | |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |




| Dimensions | Value (in mm) |
|---|---|
| **C** | 1.27 |
| **X** | 0.70 |
| **X1** | 4.51 |
| **Y** | 2.00 |
| **Y1** | 7.00 |

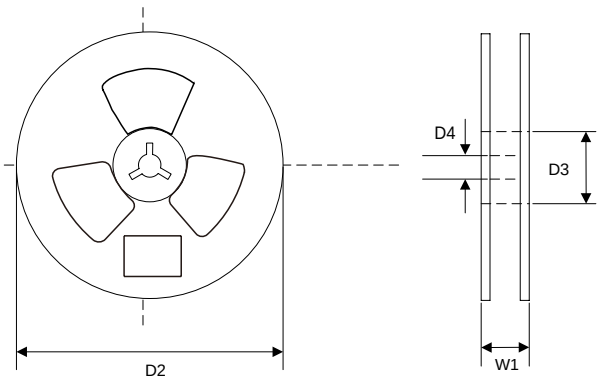
## Tape & rell specification

Tape



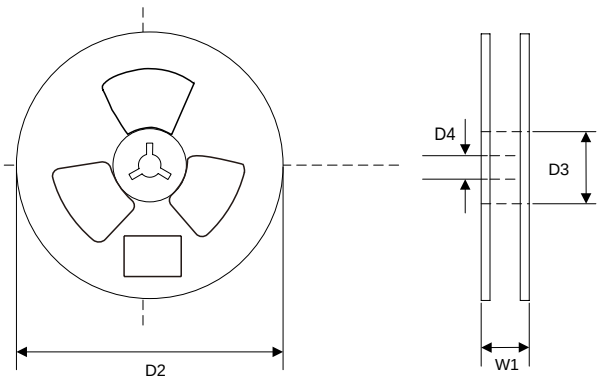

| Symbol | Dimension (mm) |
|---|---|
| P0 | 4.00±0.20 |
| P1 | 8.00±0.20 |
| P2 | 2.00±0.20 |
| D0 | 1.55±0.20 |
| D1 | 1.55±0.20 |
| E | 1.75±0.15 |
| F | 5.50±0.20 |
| W | 12.00±0.20 |
| A0 | 7.00±0.20 |
| B0 | 5.70±0.20 |
| K0 | 1.35±0.20 |
| T | 0.23±0.20 |

13” Reel




| | |
|---|---|
| D2 | 330.0±5.0 |
| D3 | 73Min. |
| D4 | 13.5±2.5 |
| W1 | 16.0±3.0 |
| Quantity: 3000PCS | |

13” Reel




| | |
|---|---|
| D2 | 330.0±5.0 |
| D3 | 73Min. |
| D4 | 13.5±2.5 |
| W1 | 16.0±3.0 |
| Quantity: 4000PCS | |

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