

## Features

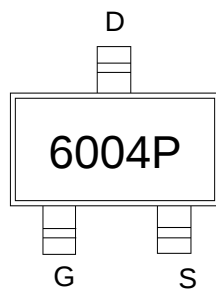
- High density cell design for ultra low  $R_{DS(on)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

## Application

- PWM applications
- Power management
- Load switch

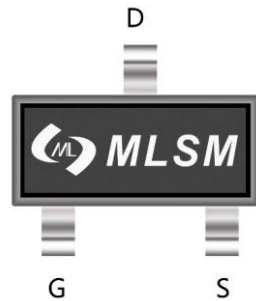
## Product Summary

| $V_{DS}$ | $R_{DS(ON)}$ TYP | $I_D$ |
|----------|------------------|-------|
| -60V     | 105mΩ@-10V       | -4A   |
|          | 150mΩ@-4.5V      |       |

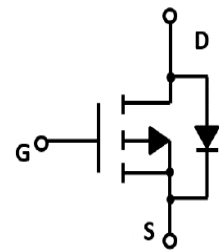


6004P: Device code

Marking and pin assignment



SOT-23-3L top view



Schematic diagram



Pb-Free



Halogen-Free

## Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| Symbol | Parameter | Rating | Unit |
|--------|-----------|--------|------|
|--------|-----------|--------|------|

### Common Ratings (TC=25°C Unless Otherwise Noted)

|           |                                  |                                |    |
|-----------|----------------------------------|--------------------------------|----|
| $V_{DS}$  | Drain-Source Breakdown Voltage   | -60                            | V  |
| $V_{GS}$  | Gate-Source Voltage              | ±20                            | V  |
| $T_J$     | Maximum Junction Temperature     | 150                            | °C |
| $T_{STG}$ | Storage Temperature Range        | -55 to 150                     | °C |
| $I_S$     | Diode Continuous Forward Current | $T_C=25^\circ\text{C}$<br>-4.0 | A  |

### Mounted on Large Heat Sink

|                 |                                        |                                |      |
|-----------------|----------------------------------------|--------------------------------|------|
| $I_{DM}$        | Pulse Drain Current Tested             | $T_C=25^\circ\text{C}$<br>-16  | A    |
| $I_D$           | Continuous Drain Current               | $T_C=25^\circ\text{C}$<br>-4.0 | A    |
| $P_D$           | Maximum Power Dissipation              | $T_C=25^\circ\text{C}$<br>-1.5 | W    |
| $R_{\theta JA}$ | Thermal Resistance Junction-to-Ambient | 113                            | °C/W |

## Ordering Information (Example)

| Type      | Package   | Marking | Minimum Package(pcs) | Inner Box Quantity(pcs) | Outer Carton Quantity(pcs) | Delivery Mode |
|-----------|-----------|---------|----------------------|-------------------------|----------------------------|---------------|
| MLSK6004P | SOT-23-3L | 6004P   | 3,000                | 45,000                  | 180,000                    | 7" reel       |

| Electrical Characteristics (T <sub>J</sub> =25 °C unless otherwise noted)            |                                  |                                                                                            |      |      |      |      |
|--------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------|------|------|------|------|
| Symbol                                                                               | Parameter                        | Condition                                                                                  | Min  | Typ  | Max  | Unit |
| Static Electrical Characteristics @ T <sub>J</sub> = 25°C (unless otherwise stated)  |                                  |                                                                                            |      |      |      |      |
| BV <sub>(BR)DSS</sub>                                                                | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA                                                | -60  | --   | --   | V    |
| I <sub>DSS</sub>                                                                     | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =-60V, V <sub>GS</sub> =0V                                                 | --   | --   | -1.0 | μA   |
| I <sub>GSS</sub>                                                                     | Gate-Body Leakage Current        | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                 | --   | --   | ±100 | nA   |
| V <sub>GS(th)</sub>                                                                  | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                  | -1.0 | -1.8 | -2.5 | V    |
| R <sub>DS(on)</sub>                                                                  | Drain-Source On-State Resistance | V <sub>GS</sub> =-10V, I <sub>D</sub> =-2A                                                 | --   | 105  | 150  | mΩ   |
|                                                                                      |                                  | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-1A                                                | --   | 150  | 200  | mΩ   |
| Dynamic Electrical Characteristics @ T <sub>J</sub> = 25°C (unless otherwise stated) |                                  |                                                                                            |      |      |      |      |
| C <sub>ISS</sub>                                                                     | Input Capacitance                | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz                                         | --   | 715  | --   | pF   |
| C <sub>OSS</sub>                                                                     | Output Capacitance               |                                                                                            | --   | 51   | --   | pF   |
| C <sub>RSS</sub>                                                                     | Reverse Transfer Capacitance     |                                                                                            | --   | 34   | --   | pF   |
| Switching Characteristics                                                            |                                  |                                                                                            |      |      |      |      |
| Q <sub>g</sub>                                                                       | Total Gate Charge                | V <sub>DS</sub> =-20V, I <sub>D</sub> =-2A,<br>V <sub>GS</sub> =-4.5V                      | --   | 6    | --   | nC   |
| Q <sub>gs</sub>                                                                      | Gate Source Charge               |                                                                                            | --   | 3    | --   | nC   |
| Q <sub>gd</sub>                                                                      | Gate Drain Charge                |                                                                                            | --   | 2    | --   | nC   |
| t <sub>d(on)</sub>                                                                   | Turn-on Delay Time               | V <sub>DD</sub> =-12V, I <sub>D</sub> =-1A,<br>V <sub>GS</sub> =-10V, R <sub>G</sub> =3.3Ω | --   | 10   | --   | nS   |
| t <sub>r</sub>                                                                       | Turn-on Rise Time                |                                                                                            | --   | 17   | --   | nS   |
| t <sub>d(off)</sub>                                                                  | Turn-Off Delay Time              |                                                                                            | --   | 22   | --   | nS   |
| t <sub>f</sub>                                                                       | Turn-Off Fall Time               |                                                                                            | --   | 21   | --   | nS   |
| Source- Drain Diode Characteristics                                                  |                                  |                                                                                            |      |      |      |      |
| V <sub>SD</sub>                                                                      | Forward on voltage               | T <sub>J</sub> =25°C, I <sub>S</sub> =-4A                                                  | --   | --   | -1.2 | V    |

## Typical Operating Characteristics

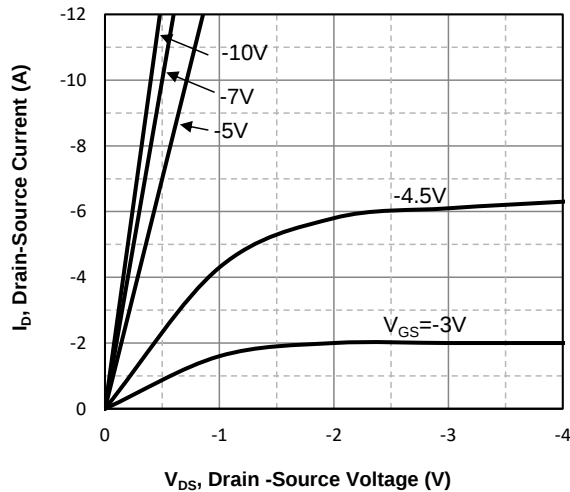


Fig1. Typical Output Characteristics

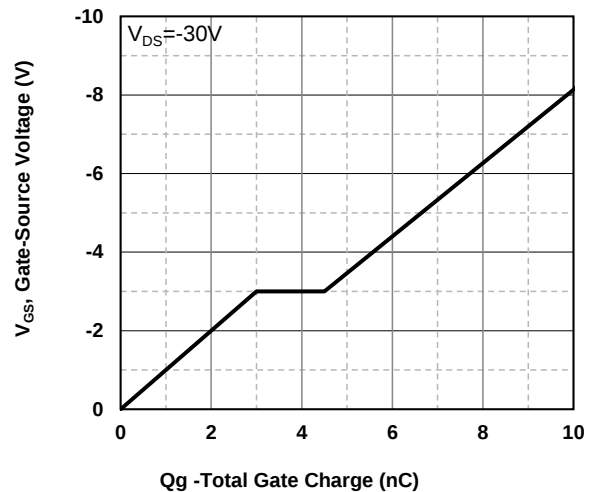


Fig2. Typical Gate Charge Vs. Gate-Source Voltage

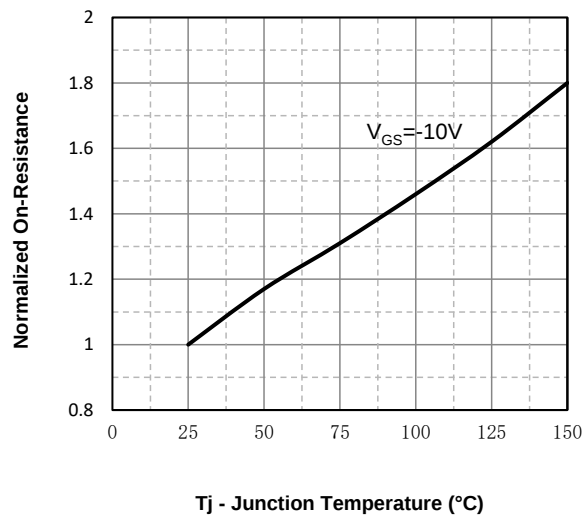


Fig3. Normalized On-Resistance Vs. Temperature

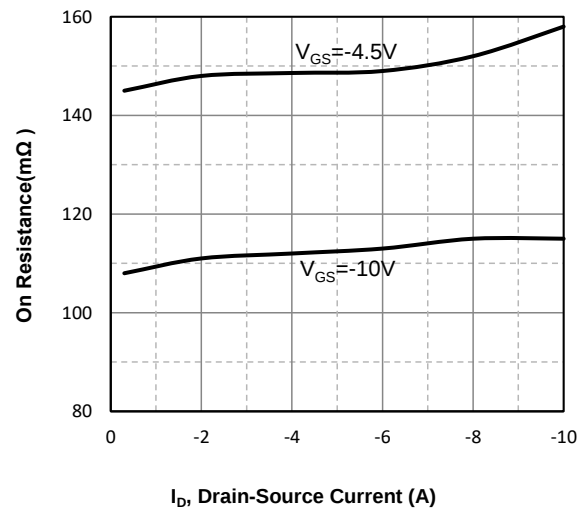


Fig4. On Resistance Vs. Drain-Source Current

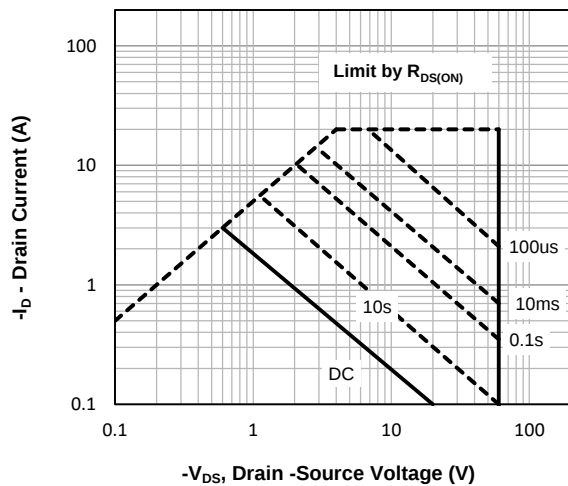


Fig5. Maximum Safe Operating Area

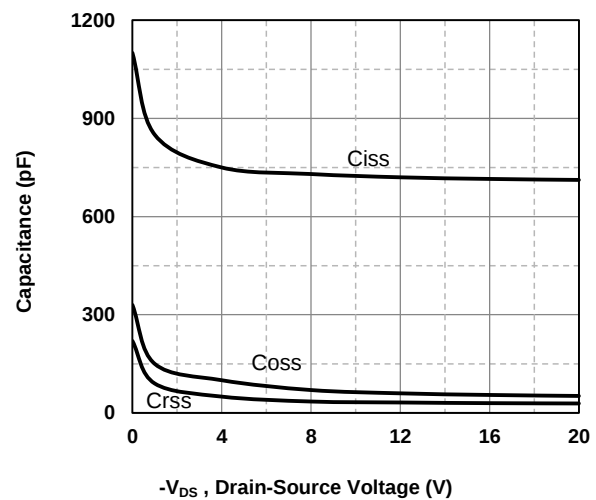
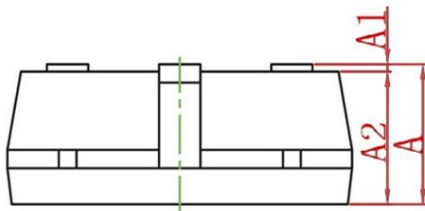
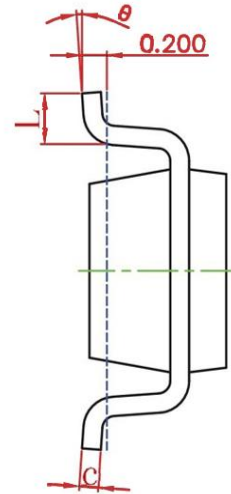
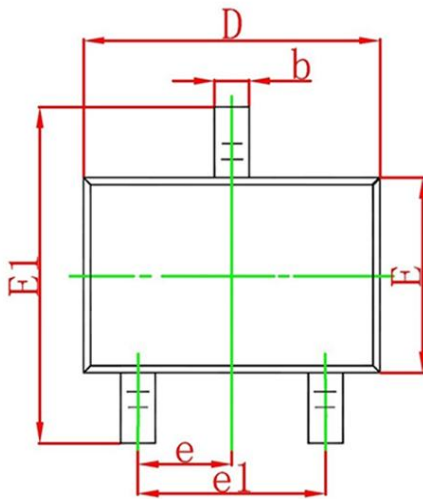


Fig6 Typical Capacitance Vs. Drain-Source Voltage

SOT-23-3L Package information



| Symbol | Dimensions in Millimeters(mm) |       | Dimensions In Inches |       |
|--------|-------------------------------|-------|----------------------|-------|
|        | Min                           | Max   | Min                  | Max   |
| A      | 1.050                         | 1.250 | 0.042                | 0.050 |
| A1     | 0.000                         | 0.100 | 0.000                | 0.004 |
| A2     | 1.050                         | 1.150 | 0.042                | 0.046 |
| b      | 0.300                         | 0.500 | 0.012                | 0.020 |
| c      | 0.100                         | 0.200 | 0.004                | 0.008 |
| D      | 2.820                         | 3.020 | 0.112                | 0.120 |
| E      | 1.500                         | 1.700 | 0.060                | 0.068 |
| E1     | 2.650                         | 2.950 | 0.106                | 0.118 |
| e      | 0.950TYP                      |       | 0.037TYP             |       |
| e1     | 1.800                         | 2.000 | 0.071                | 0.079 |
| L      | 0.300                         | 0.600 | 0.012                | 0.024 |
| θ      | 0°                            | 8°    | 0°                   | 8°    |