

# Si4963DY

## Dual P-Channel 2.5V Specified PowerTrench<sup>®</sup> MOSFET

### General Description

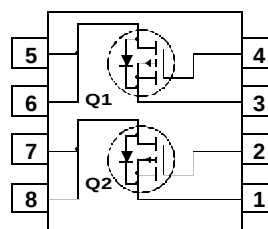
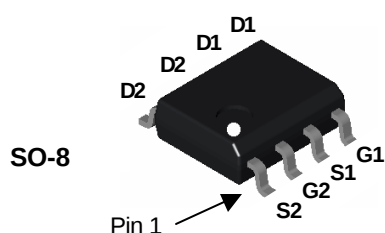
This P-Channel 2.5V specified MOSFET is a rugged gate version of Fairchild Semiconductor's advanced PowerTrench process. It has been optimized for power management applications with a wide range of gate drive voltage (2.5V – 12V).

### Applications

- Load switch
- Motor drive
- DC/DC conversion
- Power management

### Features

- –6.2 A, –20 V,  $R_{DS(ON)} = 33\text{ m}\Omega$  @  $V_{GS} = -4.5\text{ V}$   
 $R_{DS(ON)} = 50\text{ m}\Omega$  @  $V_{GS} = -2.5\text{ V}$
- Extended  $V_{GSS}$  range ( $\pm 12\text{V}$ ) for battery applications
- Low gate charge
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability



### Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol         | Parameter                                        | Ratings     | Units            |
|----------------|--------------------------------------------------|-------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage                             | –20         | V                |
| $V_{GSS}$      | Gate-Source Voltage                              | $\pm 12$    | V                |
| $I_D$          | Drain Current – Continuous (Note 1a)             | –6.2        | A                |
|                | – Pulsed                                         | –40         |                  |
| $P_D$          | Power Dissipation for Dual Operation             | 2           | W                |
|                | Power Dissipation for Single Operation (Note 1a) | 1.6         |                  |
|                | (Note 1b)                                        | 1           |                  |
|                | (Note 1c)                                        | 0.9         |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | –55 to +175 | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                                   |    |                    |
|-----------------|---------------------------------------------------|----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 78 | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 40 | $^\circ\text{C/W}$ |

### Package Marking and Ordering Information

| Device Marking | Device   | Reel Size | Tape width | Quantity   |
|----------------|----------|-----------|------------|------------|
| 4963           | Si4963DY | 13"       | 12mm       | 2500 units |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**Off Characteristics**

|                                      |                                           |                                                                    |     |     |      |                      |
|--------------------------------------|-------------------------------------------|--------------------------------------------------------------------|-----|-----|------|----------------------|
| $BV_{DSS}$                           | Drain–Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$               | -20 |     |      | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ |     | -16 |      | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$                       |     |     | -1   | $\mu\text{A}$        |
| $I_{GSSF}$                           | Gate–Body Leakage, Forward                | $V_{GS} = -12\text{ V}, V_{DS} = 0\text{ V}$                       |     |     | -100 | nA                   |
| $I_{GSSR}$                           | Gate–Body Leakage, Reverse                | $V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$                        |     |     | 100  | nA                   |

**On Characteristics (Note 2)**

|                                        |                                                |                                                                                                                                                                        |      |                |                |                      |
|----------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------|----------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$                                                                                                                       | -0.6 | -1.0           | -1.5           | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$                                                                                                     |      | 3              |                | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain–Source On–Resistance              | $V_{GS} = -4.5\text{ V}, I_D = -6.2\text{ A}$<br>$V_{GS} = -2.5\text{ V}, I_D = -5\text{ A}$<br>$V_{GS} = -4.5\text{ V}, I_D = -6.2\text{ A}, T_J = 125^\circ\text{C}$ |      | 23<br>34<br>45 | 33<br>50<br>56 | m $\Omega$           |
| $I_{D(on)}$                            | On–State Drain Current                         | $V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$                                                                                                                         | -15  |                |                | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = -5\text{ V}, I_D = -6.2\text{ A}$                                                                                                                            |      | 19             |                | S                    |

**Dynamic Characteristics**

|           |                              |                                                                       |  |      |  |    |
|-----------|------------------------------|-----------------------------------------------------------------------|--|------|--|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ |  | 1456 |  | pF |
| $C_{oss}$ | Output Capacitance           |                                                                       |  | 300  |  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                       |  | 150  |  | pF |

**Switching Characteristics (Note 2)**

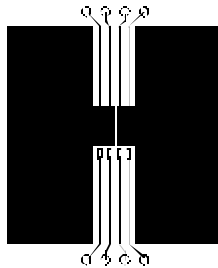
|              |                     |                                                                                                    |  |    |    |    |
|--------------|---------------------|----------------------------------------------------------------------------------------------------|--|----|----|----|
| $t_{d(on)}$  | Turn–On Delay Time  | $V_{DD} = -10\text{ V}, I_D = -1\text{ A},$<br>$V_{GS} = -4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$ |  | 15 | 27 | ns |
| $t_r$        | Turn–On Rise Time   |                                                                                                    |  | 11 | 20 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time |                                                                                                    |  | 57 | 91 | ns |
| $t_f$        | Turn–Off Fall Time  |                                                                                                    |  | 37 | 59 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = -10\text{ V}, I_D = -6.2\text{ A},$<br>$V_{GS} = -4.5\text{ V}$                          |  | 14 | 20 | nC |
| $Q_{gs}$     | Gate–Source Charge  |                                                                                                    |  | 3  |    | nC |
| $Q_{gd}$     | Gate–Drain Charge   |                                                                                                    |  | 5  |    | nC |

**Drain–Source Diode Characteristics and Maximum Ratings**

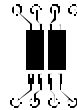
|          |                                                       |                                                     |  |      |      |   |
|----------|-------------------------------------------------------|-----------------------------------------------------|--|------|------|---|
| $I_S$    | Maximum Continuous Drain–Source Diode Forward Current |                                                     |  |      | -1.3 | A |
| $V_{SD}$ | Drain–Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = -1.3\text{ A}$ (Note 2) |  | -0.7 | -1.2 | V |

**Notes:**

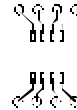
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 78°C/W when mounted on a 0.5 in<sup>2</sup> pad of 2 oz copper



b) 125°C/W when mounted on a 0.02 in<sup>2</sup> pad of 2 oz copper



c) 135°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%

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