



ON Semiconductor®

## Si4542DY

### 30V Complementary PowerTrench® MOSFET

#### General Description

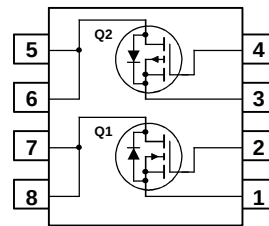
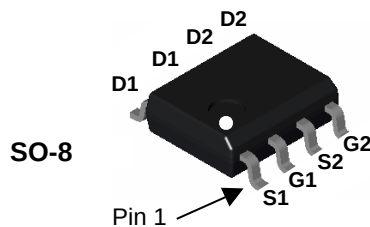
This complementary MOSFET device is produced using ON Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

#### Applications

- DC/DC converter
- Power management

#### Features

- **Q1: N-Channel**  
6 A, 30 V  $R_{DS(on)} = 28\text{ m}\Omega @ V_{GS} = 10\text{V}$   
 $R_{DS(on)} = 35\text{ m}\Omega @ V_{GS} = 4.5\text{V}$
- **Q2: P-Channel**  
-6 A, -30 V  $R_{DS(on)} = 32\text{ m}\Omega @ V_{GS} = -10\text{V}$   
 $R_{DS(on)} = 45\text{ m}\Omega @ V_{GS} = -4.5\text{V}$



#### Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol                            | Parameter                                        | Q1          | Q2  | Units |
|-----------------------------------|--------------------------------------------------|-------------|-----|-------|
| V <sub>DSS</sub>                  | Drain-Source Voltage                             | 30          | −30 | V     |
| V <sub>GSS</sub>                  | Gate-Source Voltage                              | ±20         | ±20 | V     |
| I <sub>D</sub>                    | Drain Current - Continuous (Note 1a)             | 6           | −6  | A     |
|                                   | - Pulsed                                         | 20          | −20 |       |
| P <sub>D</sub>                    | Power Dissipation for Dual Operation             | 2           |     | W     |
|                                   | Power Dissipation for Single Operation (Note 1a) | 1.6         |     |       |
|                                   | (Note 1b)                                        | 1.2         |     |       |
|                                   | (Note 1c)                                        | 1           |     |       |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Junction Temperature Range | −55 to +175 |     | °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   |
|----------------|----------|-----------|------------|------------|
| 4542           | Si4542DY | 13"       | 12mm       | 2500 units |

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

| Symbol                               | Parameter                                 | Test Conditions                                                                                                                         | Type     | Min       | Typ       | Max                    | Units                |
|--------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|-----------|------------------------|----------------------|
| <b>Off Characteristics</b>           |                                           |                                                                                                                                         |          |           |           |                        |                      |
| $BV_{DSS}$                           | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$<br>$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$                             | Q1<br>Q2 | 30<br>-30 |           |                        | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$<br>$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ | Q1<br>Q2 |           | 23<br>-21 |                        | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$<br>$V_{DS} = -24\text{ V}, V_{GS} = 0\text{ V}$                                             | Q1<br>Q2 |           |           | 1<br>-1                | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate-Body Leakage                         | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$<br>$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$                                      | Q1<br>Q2 |           |           | $\pm 100$<br>$\pm 100$ | nA                   |

**On Characteristics** (Note 2)

|                                        |                                                |                                                                                                                                                                                                                                                                                                                                |                  |           |                                  |                                  |                      |
|----------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------|----------------------------------|----------------------------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$<br>$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$                                                                                                                                                                                                                            | Q1<br>Q2         | 1<br>-1   | 1.5<br>-1.7                      | 3<br>-3                          | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$<br>$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$                                                                                                                                                                                        | Q1<br>Q2         |           | -4<br>4                          |                                  | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain-Source On-Resistance              | $V_{GS} = 10\text{ V}, I_D = 6\text{ A}$<br>$V_{GS} = 10\text{ V}, I_D = 6\text{ A}, T_J = 125^\circ\text{C}$<br>$V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$<br>$V_{GS} = -10\text{ V}, I_D = -6\text{ A}$<br>$V_{GS} = -10\text{ V}, I_D = -6\text{ A}, T_J = 125^\circ\text{C}$<br>$V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$ | Q1<br><br><br>Q2 |           | 19<br>32<br>25<br>21<br>29<br>30 | 28<br>48<br>35<br>32<br>51<br>45 | m $\Omega$           |
| $I_{D(on)}$                            | On-State Drain Current                         | $V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$<br>$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$                                                                                                                                                                                                                                   | Q1<br>Q2         | 20<br>-20 |                                  |                                  | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 15\text{ V}, I_D = 6\text{ A}$<br>$V_{DS} = -10\text{ V}, I_D = -6\text{ A}$                                                                                                                                                                                                                                         | Q1<br>Q2         |           | 18<br>16                         |                                  | S                    |

**Dynamic Characteristics**

|           |                              |                                                                      |          |  |             |  |    |
|-----------|------------------------------|----------------------------------------------------------------------|----------|--|-------------|--|----|
| $C_{iss}$ | Input Capacitance            | Q1<br>$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}$                    | Q1<br>Q2 |  | 830<br>1540 |  | pF |
| $C_{oss}$ | Output Capacitance           | $f = 1.0\text{ MHz}$<br>Q2                                           | Q1<br>Q2 |  | 185<br>400  |  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | $V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V}$<br>$f = 1.0\text{ MHz}$ | Q1<br>Q2 |  | 80<br>170   |  | pF |

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

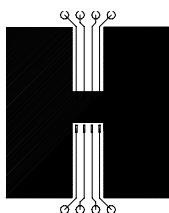
| Symbol                                    | Parameter           | Test Conditions                                                       | Type     | Min | Typ      | Max      | Units |
|-------------------------------------------|---------------------|-----------------------------------------------------------------------|----------|-----|----------|----------|-------|
| <b>Switching Characteristics</b> (Note 2) |                     |                                                                       |          |     |          |          |       |
| $t_{d(on)}$                               | Turn-On Delay Time  | Q1<br>$V_{DS} = 15\text{ V}, I_D = 1\text{ A}$                        | Q1<br>Q2 |     | 6<br>13  | 12<br>24 | ns    |
| $t_r$                                     | Turn-On Rise Time   | $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$                     | Q1<br>Q2 |     | 10<br>22 | 18<br>35 | ns    |
| $t_{d(off)}$                              | Turn-Off Delay Time | Q2<br>$V_{DS} = -15\text{ V}, I_D = -1\text{ A}$                      | Q1<br>Q2 |     | 18<br>47 | 29<br>75 | ns    |
| $t_f$                                     | Turn-Off Fall Time  | $V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$                    | Q1<br>Q2 |     | 5<br>18  | 12<br>30 | ns    |
| $Q_g$                                     | Total Gate Charge   | Q1<br>$V_{DS} = 15\text{ V}, I_D = 7.5\text{ A}, V_{GS} = 5\text{ V}$ | Q1<br>Q2 |     | 9<br>15  | 13<br>20 | nC    |
| $Q_{gs}$                                  | Gate-Source Charge  | Q2                                                                    | Q1<br>Q2 |     | 2.8<br>4 |          | nC    |
| $Q_{gd}$                                  | Gate-Drain Charge   | $V_{DS} = -10\text{ V}, I_D = -6\text{ A}, V_{GS} = -5\text{ V}$      | Q1<br>Q2 |     | 3.1<br>5 |          | nC    |

# Drain-Source Diode Characteristics and Maximum Ratings

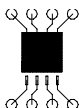
|                 |                                                       |                                                                                                                   |          |  |             |             |   |
|-----------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------|--|-------------|-------------|---|
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |                                                                                                                   | Q1<br>Q2 |  | 1.3<br>-1.3 | A           |   |
| V <sub>SD</sub> | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.3 A (Note 2)<br>V <sub>GS</sub> = 0 V, I <sub>S</sub> = -1.3 A (Note 2) | Q1<br>Q2 |  | 0.7<br>-0.7 | 1.2<br>-1.2 | V |

## Notes:

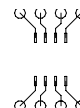
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



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 .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

- Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

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