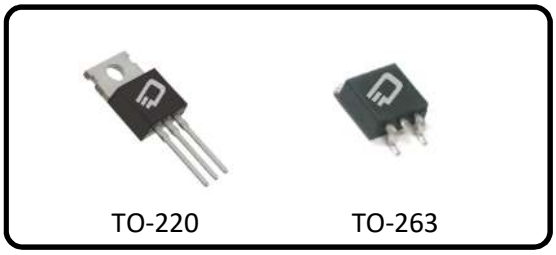
D3 SEMICONDUCTOR®
DEFINING PRECISION POWER

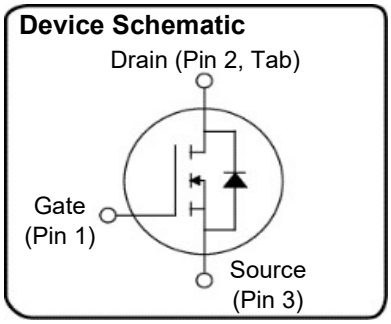
+FET™
D3S380N65x

***650V, 380mΩ, 8.5A N-Channel Enhancement Mode Super Junction Power MOSFET***

## Ordering Information

| Part Number | Package Option |
|---|---|
| D3S380N65B-U | TO-220 |
| D3S380N65E-U | TO-263 |




## Description

+FET™ is an advanced Super Junction Power MOSFET offering excellent efficiency through low Rds-ON and low gate charge. +FET™ is a rugged device with precision charge balance implementation designed for demanding uses such as enterprise power computing power supplies, motor control, lighting and other challenging power conversion applications.

### Features

- LOW $R_{DS(ON)}$
- FAST SWITCHING
- HIGH $E_{AS}$
- REL TEST SPEC: JESD-22
- HTRB >3000 HRS

### Benefits

- LOW CONDUCTION LOSSES
- HIGH EFFICIENCY
- EXCELLENT AVALANCHE PERFORMANCE

**Table 1** Key Maximum Parameters

| Parameter | Value | Unit |
|---|---|---|
| $V_{DSS}$ @ $T_{jmax}$ | 710 | V |
| RDS(on) max | < 380 | mΩ |
| Qg typ | 16 | nC |
| $I_{Dmax}$ @ 25 ºC | 13.9 | A |

### Applications

- POWER FACTOR CORRECTION
- SERVER POWER SUPPLIES
- TELECOM POWER SUPPLIES
- INVERTERS
- MOTOR CONTROL

# Contents

# 1. Maximum Ratings

## Table 2 Maximum Ratings

@ $T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Continuous drain current | $I_D$ | | | 5.4 | A | $T_c$ = 100ºC |
| | | | | 8.5 | A | $T_c$ = 25ºC |
| Pulsed drain current | $I_{D, pulse}$ | | | 34 | A | $T_c$ = 25ºC |
| Avalanche energy, single pulse | $E_{AS}$ | | | 304 | mJ | $I_D$ = 3.5A; $V_{DD}$ = 50V, VGS = 10V, L=50mH, RG=25 Ohms |
| Avalanche energy, repetitive | $E_{AR}$ | | | 0.456 | mJ | $I_D$ = 1.5; $V_{DD}$ = 50V |
| Avalanche current, single pulse | $I_{AS}$ | | | 1.34 | A | |
| MOSFET dv/dt ruggedness | dv/dt | | | 50 | V/ns | $V_{DS}$ = 0….480V |
| Gate source voltage (static) | $V_{GS}$ | -30 | | 30 | V | Static |
| Gate source voltage (dynamic) | $V_{GS}$ | -30 | | 30 | V | AC (F>1Hz) |
| Power dissipation | $P_{tot}$ | | | 62 | W | TO-220, TO-263, $T_c$ = 25ºC |
| Storage temperature | $T_{stg}$ | -55 | | 150 | ºC | |
| Operating junction temperature | $T_j$ | -55 | | 150 | ºC | |
| Mounting torque | | | | 60 | N-cm | M3 and M3.5 screws |
| Continuous diode forward current | $I_{SD}$ | | | 8.5 | A | Tc = 25ºC |
| Diode pulse current | $I_{S, pulse}$ | | | 34 | A | Tc = 25ºC |
| Reverse diode dv/dt | dv/dt | | | 15 | V/ns | $V_{DS}$=0…480V, $I_{SD}$<=$I_S$, $T_j$ = 25ºC |
| Maximum diode commutation speed | $di_f/dt$ | | | 500 | A/µs | $V_{DS}$=0…480V, $I_{SD}$<=$I_S$, $T_j$ = 25ºC |

## 2. Thermal Characteristics

**Table 3** Thermal Characteristics

| Symbol | Parameter | Values | | | | Unit |
|---|---|---|---|---|---|---|
| | | TO-220 | TO-220FP | TO-263 | TO-247 | |
| $R_{th\text{-}jC}$ | Thermal resistance, junction-case | 2.0 | 8.2 | 2.0 | TBD | ºC/W |
| $R_{th\text{-}jA}$ | Thermal resistance, junction-ambient | 65 | 65 | 65 | TBD | ºC/W |
| $T_S$ | Soldering temperature, wave soldering only allowed at leads | 260 | 260 | 260 | TBD | ºC |

# 3. Electrical Characteristics

@ $T_j$ = 25ºC, unless otherwise specified

## Table 4 Static Characteristics

| Parameter | Symbol | Values | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | 650 | | | V | $I_D$ = 1mA, $V_{GS}$ = 0V |
| Gate threshold voltage | $V_{GS(TH)}$ | 2.3 | 3 | 3.7 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 47uA |
| Zero gate voltage drain current | $I_{DSS}$ | | | 1 | μA | $V_{DS}$ = 650V, $T_C$ = 25ºC, $V_{GS}$ = 0V |
| | | | | 50 | | $V_{DS}$ = 650V, $T_C$ = 125ºC, $V_{GS}$ = 0V |
| Gate-source leakage current | $I_{GSS}$ | | | 100 | nA | $V_{GS}$ = ±30V, $V_{DS}$ = 0V |
| Drain-source on-state resistance | $R_{DS(on)}$ | | 0.35 | 0.38 | Ω | $V_{GS}$ = 10V, $I_D$ = 4.3 A, $T_J$ = 25ºC |
| | | | 0.86 | | Ω | $V_{GS}$ = 10V, $I_D$ = 4.3 A, $T_J$ = 150ºC |
| Gate resistance*** | $R_G$ | | 1 | | Ω | |

## Table 5 Dynamic Characteristics

| Parameter | Symbol | Values | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Input capacitance | $C_{iss}$ | | 777 | | pF | $V_{DS}$ = 100V, f = 1MHz, $V_{GS}$ = 0V |
| Output capacitance | $C_{oss}$ | | 26.2 | | pF | |
| Reverse transfer capacitance | $C_{rss}$ | | 7.4 | | pF | |
| Turn-on delay time | $t_{d(on)}$ | | 10.5 | | ns | $V_{DD}$ = 400V, $I_D$ = 4.3A $R_G$ = 1Ω, $V_{GS}$ = 10V |
| Rise time | $t_r$ | | 20 | | ns | |
| Turn-off delay time | $t_{d(off)}$ | | 35 | | ns | |
| Fall time | $t_f$ | | 21 | | ns | |

## Table 6 Gate Charge Characteristics

| Parameter | Symbol | Values | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Gate to source charge | $Q_{gs}$ | | 3.1 | | nC | $V_{DD}$ = 480V, $I_D$ = 4.3A, $V_{GS}$ = 0 to 10V |
| Gate to drain charge | $Q_{gd}$ | | 5.8 | | nC | |
| Gate charge total | $Q_g$ | | 15.4 | | nC | |
| Gate plateau voltage | $V_{plateau}$ | | 5 | | V | |

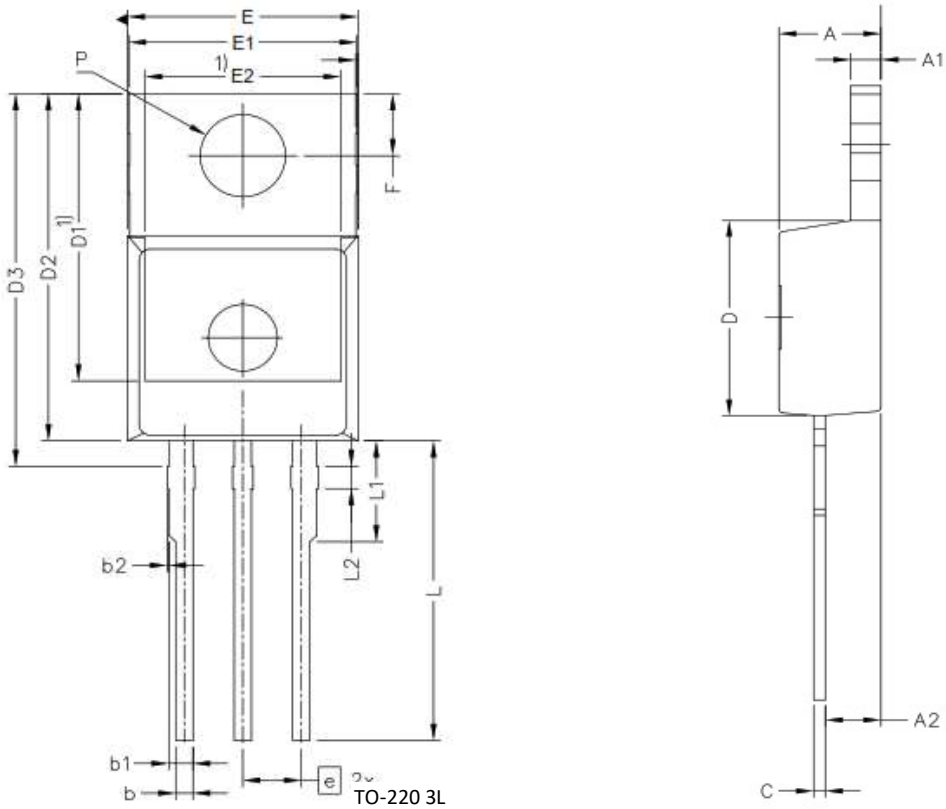
**Table 7** Reverse Diode Characteristics

| Parameter | Symbol | Values | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Diode source-drain current | $I_{SD}$ | | | 8.5 | A | |
| Diode forward voltage | $V_{fd}$ | | 0.95 | 1.5 | V | $I_{SD}$ = 8.5A, $V_{GS}$ = 0V, $T_J$ = 25ºC |
| Reverse recovery time | $t_{rr}$ | | 244 | | ns | $I_F$ = 8.5A, L = 5mH di/dt = 100A/µS $V_{DD}$ = 60V, $T_J$ = 25ºC |
| Reverse recovery charge | $Q_{rr}$ | | 3.1 | | µC | |
| Peak reverse recovery current | $I_{rrm}$ | | 14.6 | | A | |

# 4. Package Outlines

### 4a) TO-220

## D3 Semiconductor TO-220-3L

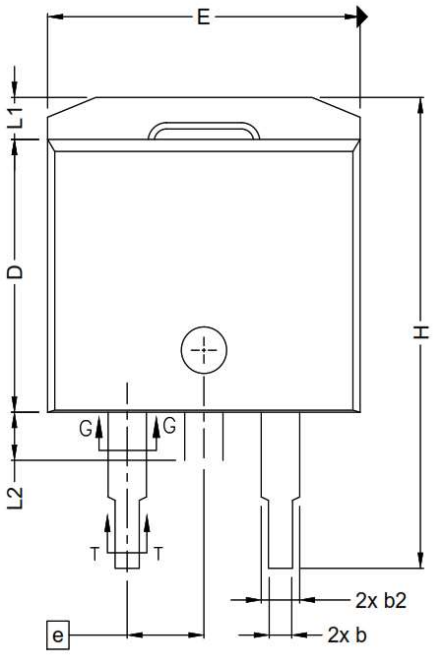


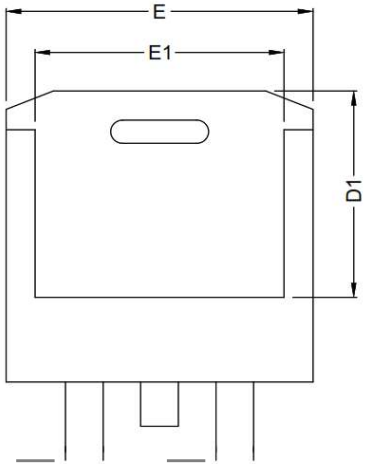

TO-220 3L

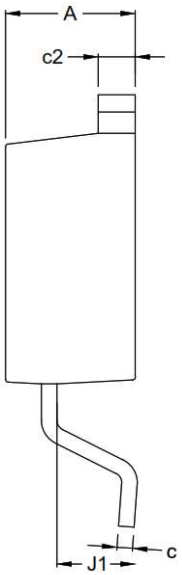
| SYMBOL | MIN | MAX |
|---|---|---|
| A | 4.20 | 4.60 |
| A1 | 1.20 | 1.40 |
| A2 | 2.20 | 2.60 |
| b | 0.65 | 0.85 |
| b1 | 0.95 | 1.15 |
| b2 | | 0.15 |
| C | 0.40 | 0.60 |
| D | 9.05 | 9.45 |
| D1 | 12.95 | |
| D2 | 15.35 | 15.95 |
| D3 | 16.50 | 17.10 |
| E | 9.80 | 10.20 |
| E1 | 9.70 | 10.10 |
| E2 | 8.50 | |
| e | 2.46 | 2.54 |
| F | 2.60 | 3.00 |
| L | 13.00 | 14.00 |
| L1 | 4.35 | 4.75 |
| L2 | 0.90 | 1.10 |
| P | 3.55 | 3.85 |

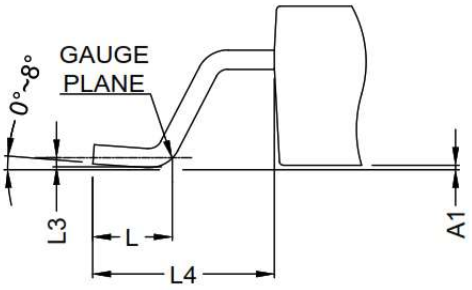
**4b) TO-263**

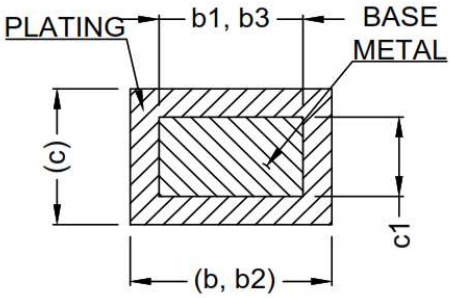
# D3 Semiconductor TO-263 (D2PAK)




TO-263 (D2PAK)

| SYMBOL | MIN. | MAX. |
|---|---|---|
| A | 4.36 | 4.56 |
| A1 | 0 | 0.25 |
| b | 0.7 | 0.9 |
| b1 | 0.51 | 0.89 |
| b2 | 1.2 | 1.46 |
| b3 | 1.17 | 1.37 |
| c | 0.38 | 0.694 |
| c1 | 0.38 | 0.534 |
| c2 | 1.19 | 1.34 |
| D | 8.6 | 9 |
| D1 | 6.9 | 7.5 |
| E | 10.15 | 10.55 |
| E1 | 8.1 | 8.7 |
| e | 2.46 | 2.54 |
| H | 15 | 15.6 |
| L | 1.9 | 2.5 |
| L1 | - | 1.65 |
| L2 | - | 1.78 |
| L3 | 0.25 TYP | |
| L4 | 4.78 | 5.28 |
| J1 | 2.56 | 2.96 |

## 5. Revision History

| Revision | Release Date | Comments |
|---|---|---|
| 1.0 | 1-November-2016 | Preliminary Datasheet Release |
| 1.1 | 1-July-2017 | Updated tables and package information |
| | | |

## 6. Resources

www.d3semi.com

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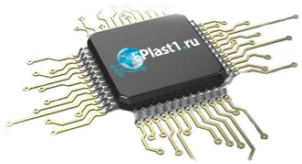


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