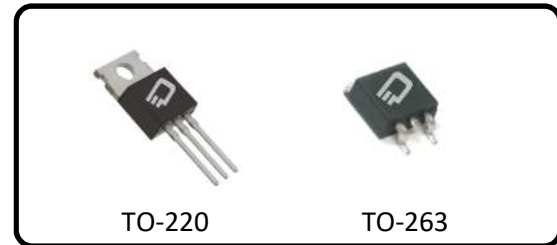


**650V, 280mΩ, 11.6A N-Channel Enhancement Mode Super Junction Power MOSFET**

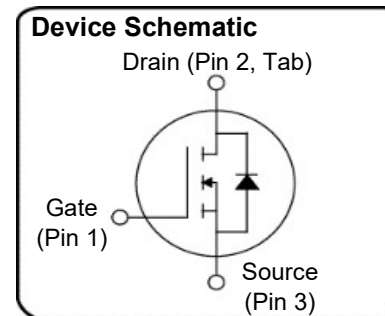
## Ordering Information

Part Number	Package Option
D3S280N65B-U	TO-220
D3S280N65E-U	TO-263



## Description

+FET<sup>™</sup> is an advanced Super Junction Power MOSFET offering excellent efficiency through low R<sub>ds-ON</sub> and low gate charge. +FET<sup>™</sup> 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<sub>DS(ON)</sub>
- FAST SWITCHING
- HIGH E<sub>AS</sub>
- REL TEST SPEC: JESD-22
- HTRB >3000 HRS

### Benefits

- LOW CONDUCTION LOSSES
- HIGH EFFICIENCY
- EXCELLENT AVALANCHE PERFORMANCE

**Table 1** Key Parameters

Parameter	Value	Unit
V <sub>DSS</sub> @ T <sub>Jmax</sub>	710	V
R <sub>DS(on)</sub> max	< 280	mΩ
Q <sub>g</sub> typ	22	nC
I <sub>Dmax</sub> @ 25 °C	19.0	A

### Applications

- POWER FACTOR CORRECTION
- SERVER POWER SUPPLIES
- TELECOM POWER SUPPLIES
- INVERTER WELDERS
- MOTOR CONTROL

## Contents

Contents.....	2
1. Maximum Ratings .....	3
2. Thermal Characteristics .....	4
3. Electrical Characteristics .....	5
4. Package Outlines.....	7
5. Revision History .....	9
6. Resources.....	9
7. Patents, Copyrights and Trademarks.....	9
8. Legal Disclaimer .....	9

## 1. Maximum Ratings

**Table 2** Maximum Ratings

 @  $T_j = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Continuous drain current	$I_D$			7.3	A	$T_c = 100^\circ\text{C}$
				11.6	A	$T_c = 25^\circ\text{C}$
Pulsed drain current	$I_{D, \text{pulse}}$			46	A	$T_c = 25^\circ\text{C}$
Avalanche energy, single pulse	$E_{AS}$			260	mJ	$I_D = 5.1\text{A}; V_{DD} = 50\text{V}, V_{GS} = 10\text{V}, L=10\text{mH}, R_G=25\text{ Ohms}$
Avalanche energy, repetitive	$E_{AR}$			0.39	mJ	$I_D = 2.0; V_{DD} = 50\text{V}$
Avalanche current, single pulse	$I_{AS}$			1.8	A	
MOSFET dv/dt ruggedness	dv/dt			50	V/ns	$V_{DS} = 0 \dots 480\text{V}$
Gate source voltage (static)	$V_{GS}$	-30		30	V	Static
Gate source voltage (dynamic)	$V_{GS}$	-30		30	V	AC ( $F > 1\text{Hz}$ )
Power dissipation	$P_{tot}$			91	W	TO-220, TO-263, $T_c = 25^\circ\text{C}$
Storage temperature	$T_{stg}$	-55		150	$^\circ\text{C}$	
Operating junction temperature	$T_j$	-55		150	$^\circ\text{C}$	
Mounting torque				60	N-cm	M3 and M3.5 screws
Continuous diode forward current	$I_{SD}$			11.6	A	$T_c = 25^\circ\text{C}$
Diode pulse current	$I_{S, \text{pulse}}$			46	A	$T_c = 25^\circ\text{C}$
Reverse diode dv/dt	dv/dt			15	V/ns	$V_{DS}=0 \dots 480\text{V}, I_{SD} \leq I_S, T_j = 25^\circ\text{C}$
Maximum diode commutation speed	$di/dt$			300	A/ $\mu\text{s}$	$V_{DS}=0 \dots 480\text{V}, I_{SD} \leq I_S, T_j = 25^\circ\text{C}$

## 2. Thermal Characteristics

**Table 3** Thermal Characteristics

Symbol	Parameter	Values				Unit
		TO-220	TO-220FP	TO-263	TO-247	
$R_{th-jc}$	Thermal resistance, junction-case	1.48	5.9	1.48	TBD	°C/W
$R_{th-jA}$	Thermal resistance, junction-ambient	65	65	65	TBD	°C/W
$T_s$	Soldering temperature, wave soldering only allowed at leads	260	260	260	TBD	°C

### 3. Electrical Characteristics

@ T<sub>j</sub> = 25°C, unless otherwise specified

**Table 4** Static Characteristics

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	650			V	I <sub>D</sub> = 1mA, V <sub>GS</sub> = 0V
Gate threshold voltage	V <sub>GS(TH)</sub>	2.3	3	3.7	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 72uA
Zero gate voltage drain current	I <sub>DSS</sub>			1	μA	V <sub>DS</sub> = 650V, T <sub>C</sub> = 25°C, V <sub>GS</sub> = 0V
				50		V <sub>DS</sub> = 650V, T <sub>C</sub> = 125°C, V <sub>GS</sub> = 0V
Gate-source leakage current	I <sub>GSS</sub>			100	nA	V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V
Drain-source on-state resistance	R <sub>DS(on)</sub>		0.26	0.28	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 5.8 A, T <sub>J</sub> = 25°C
			0.63		Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 5.8 A, T <sub>J</sub> = 150°C
Gate resistance	R <sub>G</sub>		1		Ω	

**Table 5** Dynamic Characteristics

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Input capacitance	C <sub>iss</sub>		940		pF	V <sub>DS</sub> = 100V, f = 1MHz, V <sub>GS</sub> = 0V
Output capacitance	C <sub>oss</sub>		39.7		pF	
Reverse transfer capacitance	C <sub>rss</sub>		7.6		pF	
Turn-on delay time	t <sub>d(on)</sub>		5		ns	V <sub>DD</sub> = 400V, I <sub>D</sub> = 4.5A R <sub>G</sub> = 3.4Ω, V <sub>GS</sub> = 13V
Rise time	t <sub>r</sub>		5		ns	
Turn-off delay time	t <sub>d(off)</sub>		48		ns	
Fall time	t <sub>f</sub>		27		ns	

**Table 6** Gate Charge Characteristics

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Gate to source charge	Q <sub>gs</sub>		4.4		nC	V <sub>DD</sub> = 480V, I <sub>D</sub> = 5.8A, V <sub>GS</sub> = 0 to 10V
Gate to drain charge	Q <sub>gd</sub>		8.4		nC	
Gate charge total	Q <sub>g</sub>		22.2		nC	
Gate plateau voltage	V <sub>plateau</sub>		5		V	

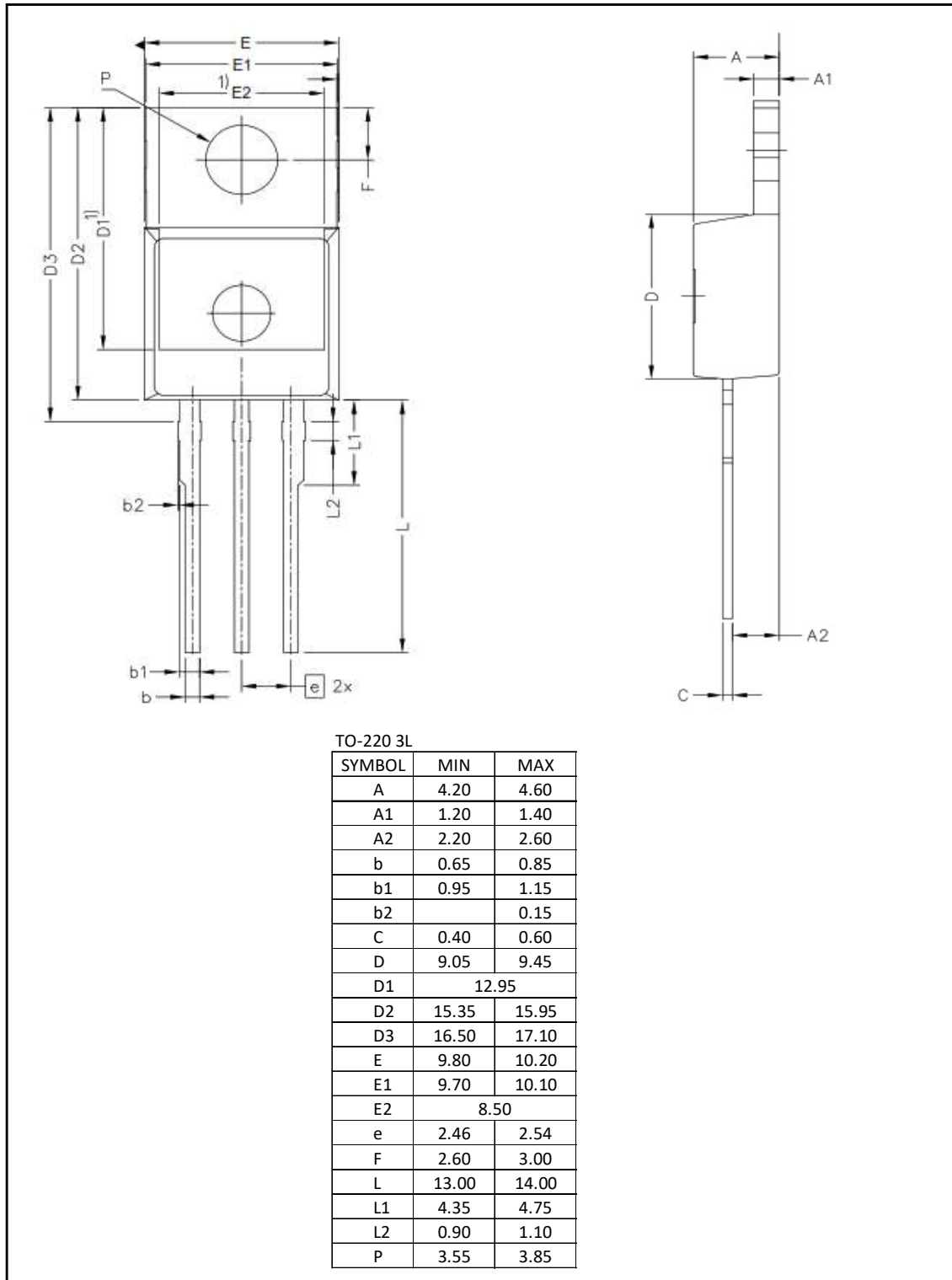
**Table 7** Reverse Diode Characteristics

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Diode source-drain current	$I_{SD}$			11.6	A	
Diode forward voltage	$V_{fd}$		0.95	1.5	V	$I_{SD} = 11.6A, V_{GS} = 0V,$ $T_J = 25^\circ C$
Reverse recovery time	$t_{rr}$		219		ns	$I_F = 11.6A,$ $L = 5mH$ $di/dt = 100A/\mu S$ $V_{DD} = 60V, T_J = 25^\circ C$
Reverse recovery charge	$Q_{rr}$		2.0		$\mu C$	
Peak reverse recovery current	$I_{rrm}$		16.9		A	

## 4. Package Outlines

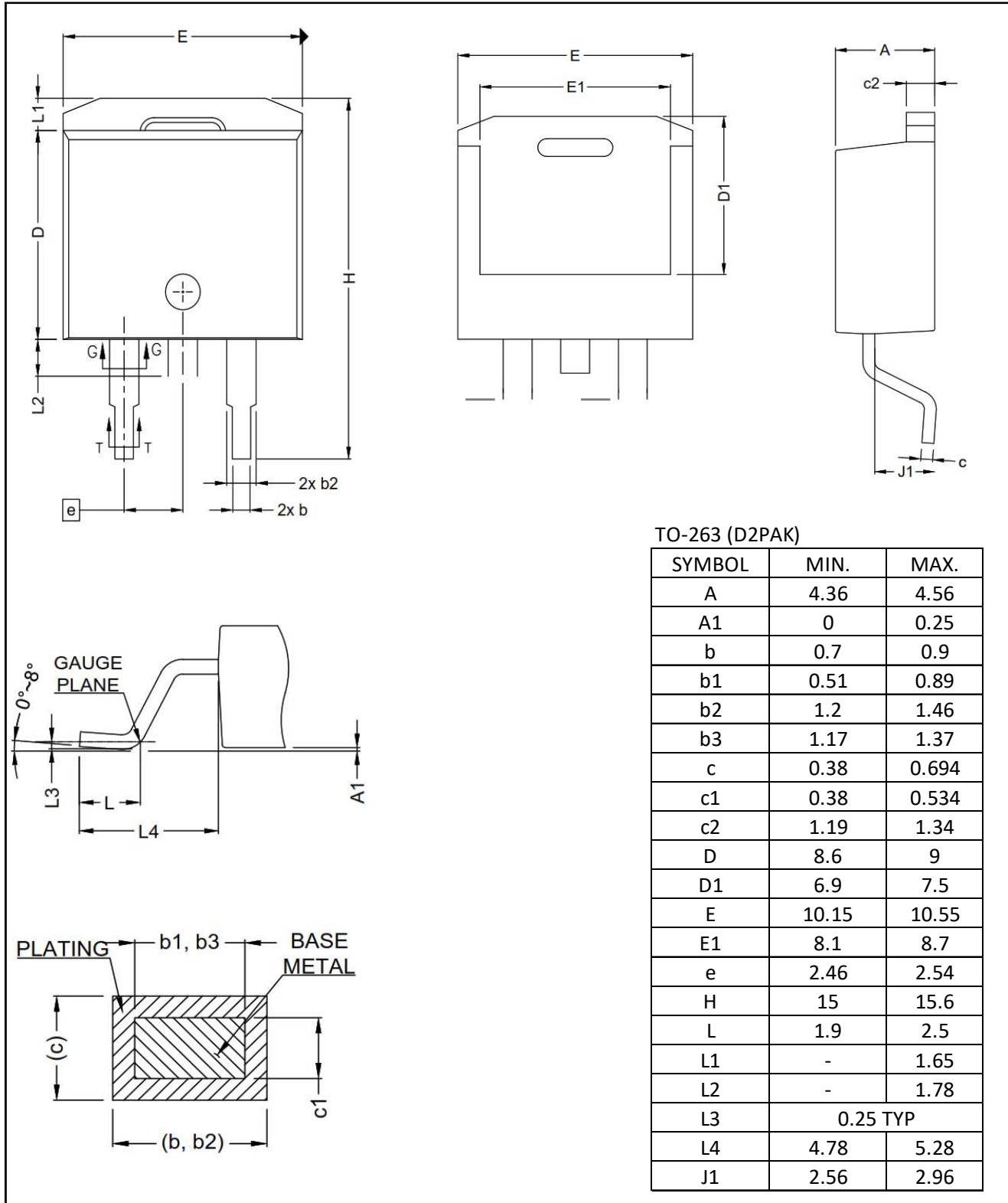
### 4a) TO-220

### D3 Semiconductor TO-220-3L



4b) TO-263

**D3 Semiconductor TO-263 (D2PAK)**





## 5. Revision History

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

## 6. Resources

[www.d3semi.com](http://www.d3semi.com)

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