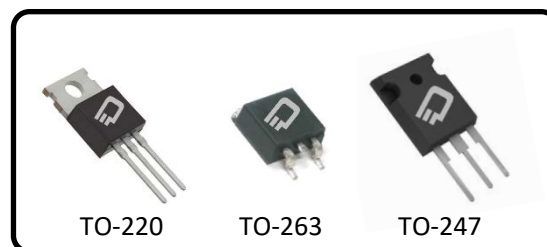


650V, 99mΩ, 31.8 A Super Junction Power MOSFET

Ordering Information

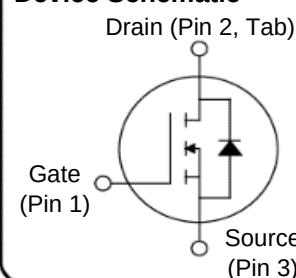
Part Number	Package Option
D3S099N65B-U	TO-220
D3S099N65D-U	TO-247
D3S099N65E-U	TO-263



Description

+FET™ is an advanced Super Junction Power MOSFET offering excellent efficiency through low $R_{DS(ON)}$ 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.

Device Schematic



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 Parameters

Parameter	Value	Unit
$V_{DSS} @ T_{jmax}$	710	V
$R_{DS(on)} max$	< 99	mΩ
$Q_g typ$	77	nC
$I_D @ 25 ^\circ C$	44.9	A

Applications

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

Contents

Contents.....	2
1. Maximum Ratings	3
2. Thermal Characteristics	4
3. Electrical Characteristics	5
4. Package Outlines.....	12
5. Revision History	16
6. Resources.....	16
7. Patents, Copyrights and Trademarks.....	16
8. Legal Disclaimer	16

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			31.8	A	T _C = 25°C
				23.7	A	T _C = 100°C
Pulsed drain current	I _{D, pulse}			127	A	T _C = 25°C
Avalanche energy, single pulse	E _{AS}			650	mJ	I _D = 8.7A; V _{DD} = 50V, V _{GS} = 10V, L=17mH, R _G =25 Ohms
Avalanche energy, repetitive	E _{AR}			1.0	mJ	I _D = 8.7A; V _{DD} = 50V
Avalanche current, repetitive	I _{AR}			8.7	A	
MOSFET dv/dt ruggedness	dv/dt			50	V/ns	V _{DS} = 0...400V
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}			154	W	TO-220, TO-263, TO-247, T _C = 25°C
Storage temperature	T _{stg}	-55		150	°C	
Operating junction temperature	T _j	-55		150	°C	
Mounting torque				60	N-cm	
Continuous diode forward current	I _{SD}			31.8	A	T _C = 25°C
Diode pulse current	I _{S, pulse}			127	A	T _C = 25°C
Reverse diode dv/dt	dv/dt			15	V/ns	V _{DS} =0...400V, I _{SD} ≤I _S , T _j = 25°C
Maximum diode commutation speed	di _f /dt			500	A/μs	V _{DS} =0...400V, I _{SD} ≤I _S , T _j = 25°C

Thermal Characteristics

Table 3 Thermal Characteristics

Symbol	Parameter	Values				Unit
		TO-220	TO-263	TO-247		
R _{thjC}	Thermal resistance, junction-case	0.81	0.81	0.81		°C/W
R _{thjA}	Thermal resistance, junction-ambient	62	62	50		°C/W
R _{thjT}	Thermal resistance, junction-ambient for SMD version		30			°C/W
T _s	Soldering temperature, wavesoldering only allowed at leads	260	260	260		°C

Electrical Characteristics

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

Table 4

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Drain-source breakdown voltage	V_{DS}	650			V	$I_D = 1\text{mA}$, $V_{GS} = 0\text{V}$
Gate threshold voltage	$V_{GS(th)}$	2.3	3	3.7	V	
Zero gate voltage drain current	I_{DSS}			1	μA	$V_{DS} = 650\text{V}$, $T_c = 25^\circ\text{C}$
				50		$V_{DS} = 650\text{V}$, $T_c = 125^\circ\text{C}$
Gate-source leakage current	I_{GSS}			100	nA	
Drain-source on-state resistance	$R_{DS(on)}$		0.062	0.099	Ω	$V_{GS} = 10\text{V}$, $I_D = 15.9\text{A}$, $T_c = 25^\circ\text{C}$
	$R_{DS(on)}$		0.160			$V_{GS} = 10\text{V}$, $I_D = 15.9\text{A}$, $T_c = 150^\circ\text{C}$
Gate resistance	R_G		1		Ω	

Table 5

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Input capacitance	C_{iss}		4240		pF	$V_{DS} = 100\text{V}$, $f = 1\text{MHz}$, $V_{GS} = 0\text{V}$
Output capacitance	C_{oss}		97.5		pF	
Reverse transfer capacitance	C_{rss}		16.5		pF	
Turn-on delay time	$t_{d(on)}$		17		ns	$V_{DD} = 400\text{V}$, $I_D = 15.9\text{A}$ $R_G = 1\Omega$, $V_{GS} = 10\text{V}$
Rise time	t_r		24		ns	
Turn-off delay time	$t_{d(off)}$		90		ns	
Fall time	t_f		23		ns	

Table 6 Gate Charge Characteristics

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Gate to source charge	Q_{gs}		16		nC	$V_{DD} = 480V$, $I_D = 15.5A$, $V_{GS} = 10V$
Gate to drain charge	Q_{gd}		27		nC	
Gate charge total	Q_g		77		nC	
Gate plateau voltage	$V_{plateau}$		5		V	

Table 7 Body Diode

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Diode source-drain current	I_{SD}			38.3	A	
Diode forward voltage	V_{fd}		0.95	1.5	V	$I_{SD} = 31.8A$, $V_{GS} = 0V$
Reverse recovery time	t_{rr}		468		ns	$I_{SD} = 31.8A$, $di/dt = 100A/\mu S$ $V_{DD} = 60V$, $T_c = 25^\circ C$
Reverse recovery charge	Q_{rr}		9.5		μC	
Peak reverse recovery current	I_{rrm}		50.0		A	

Electrical Characteristics Graphs

Table 8 Thermal Performance

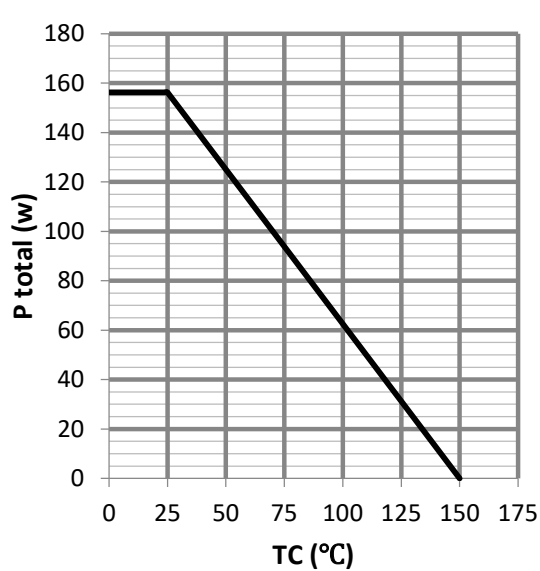
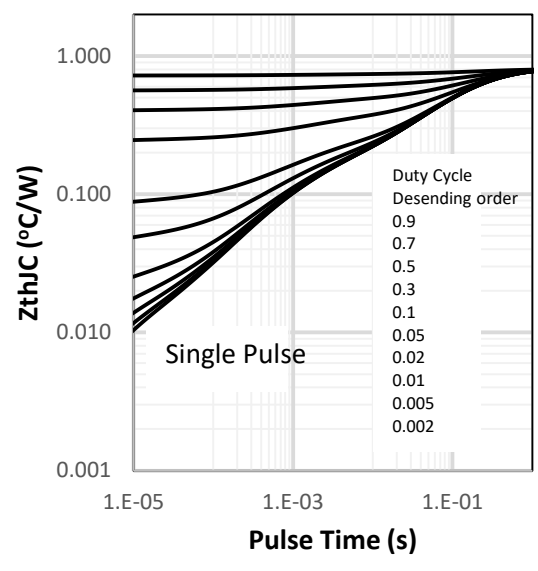
Power Dissipation	Maximum Transient Thermal Impedance
	
Max power limited by case temperature	Variable is pulse time (t_p)

Table 9 Output Characteristics

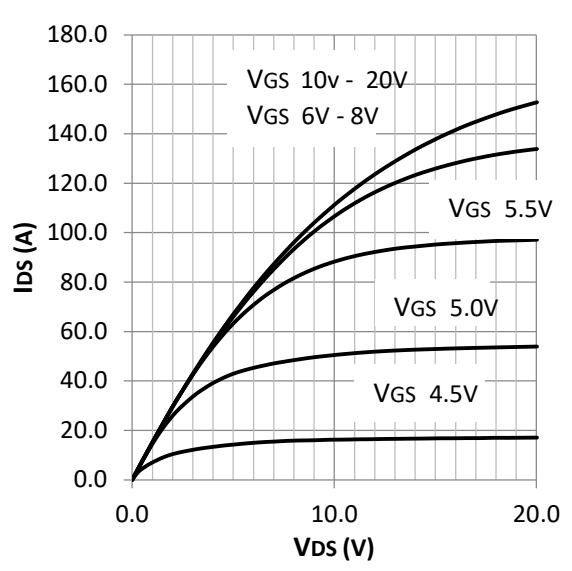
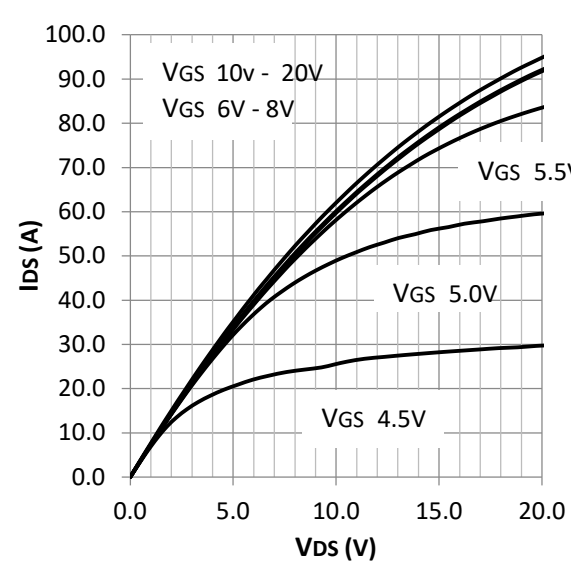
Typical Output Characteristics	Typical Output Characteristics
	
$T_C = 25^\circ\text{C}$; Variable is V_{GS}	$T_C = 125^\circ\text{C}$; Variable is V_{GS}

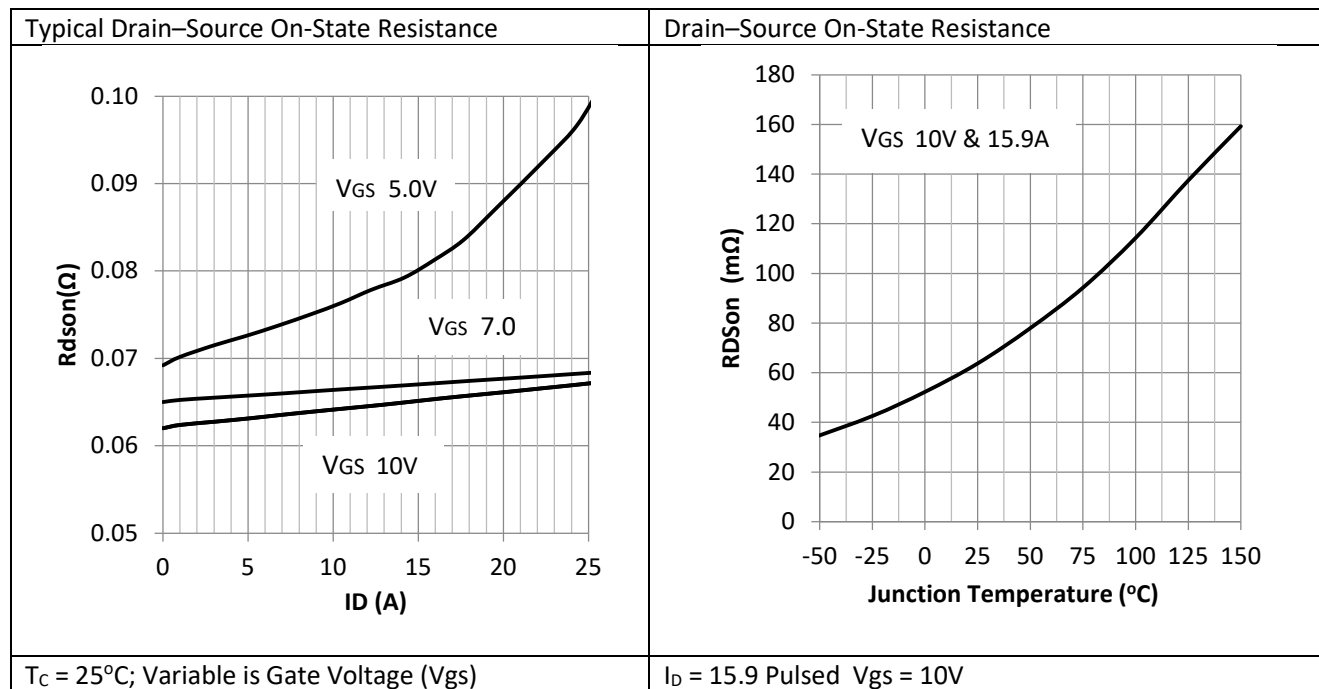
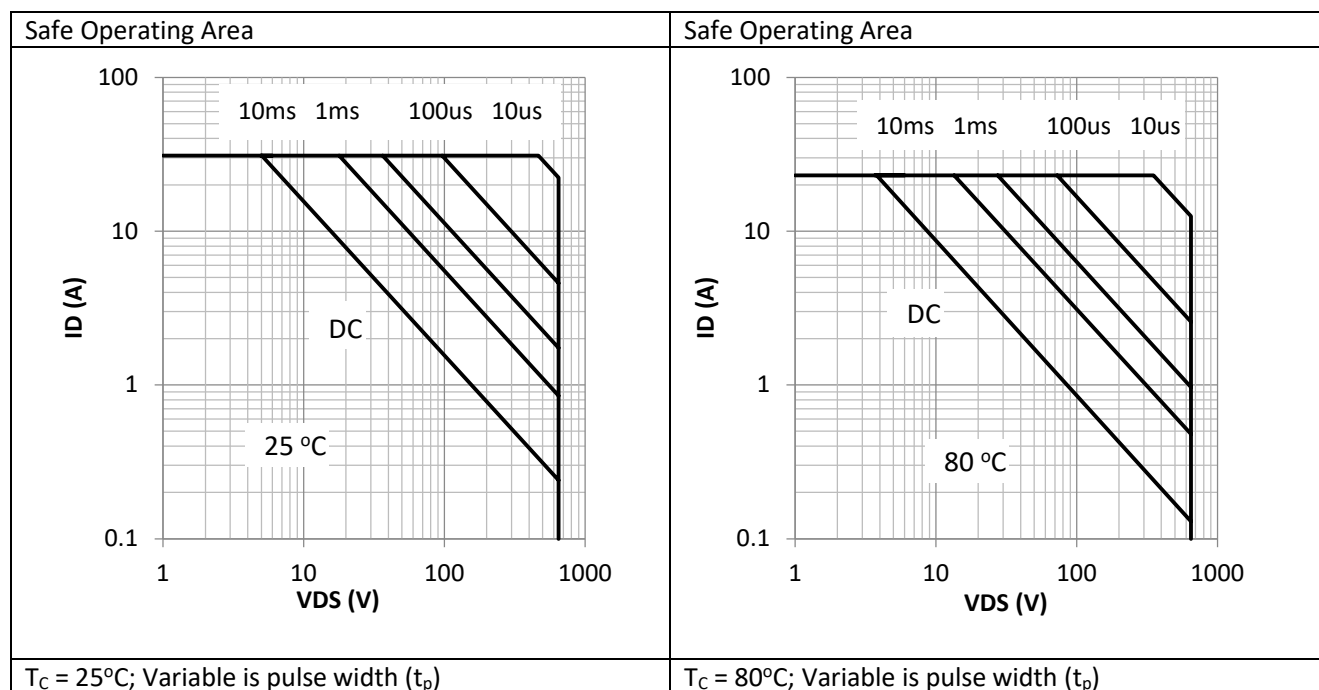
Table 10 Drain-Source Resistance

Table 11 Safe Operating Area


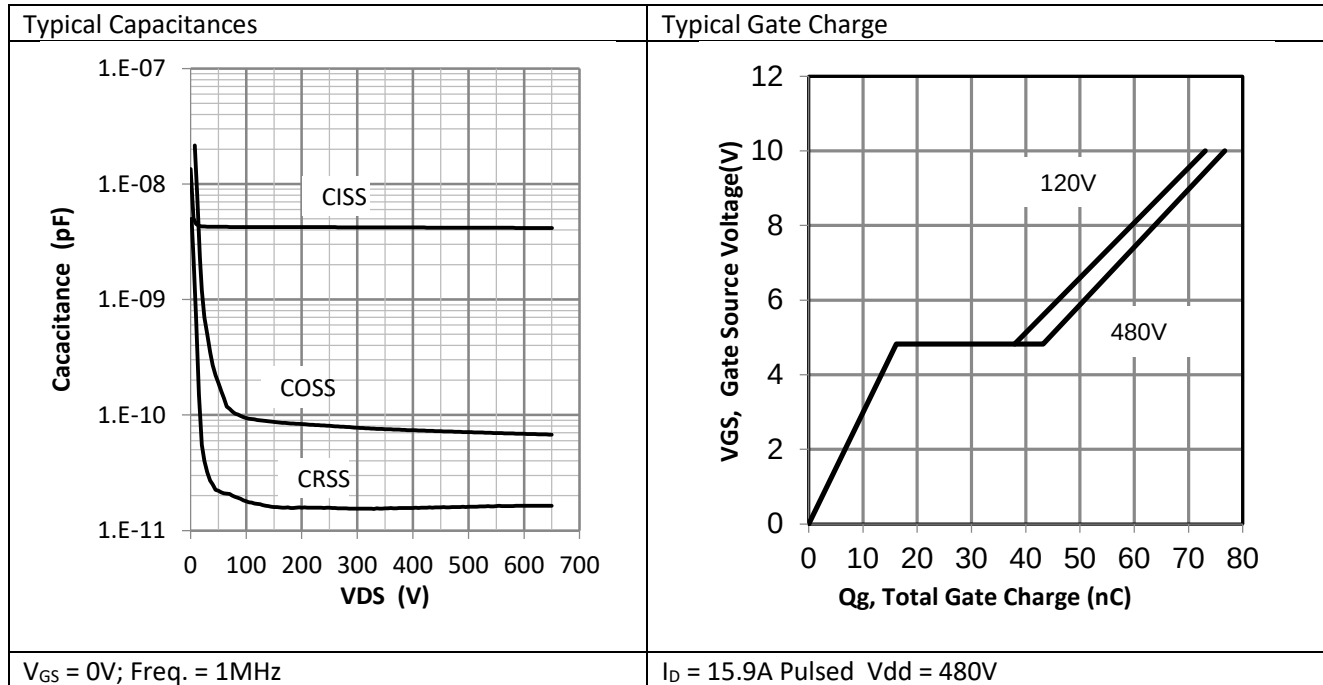
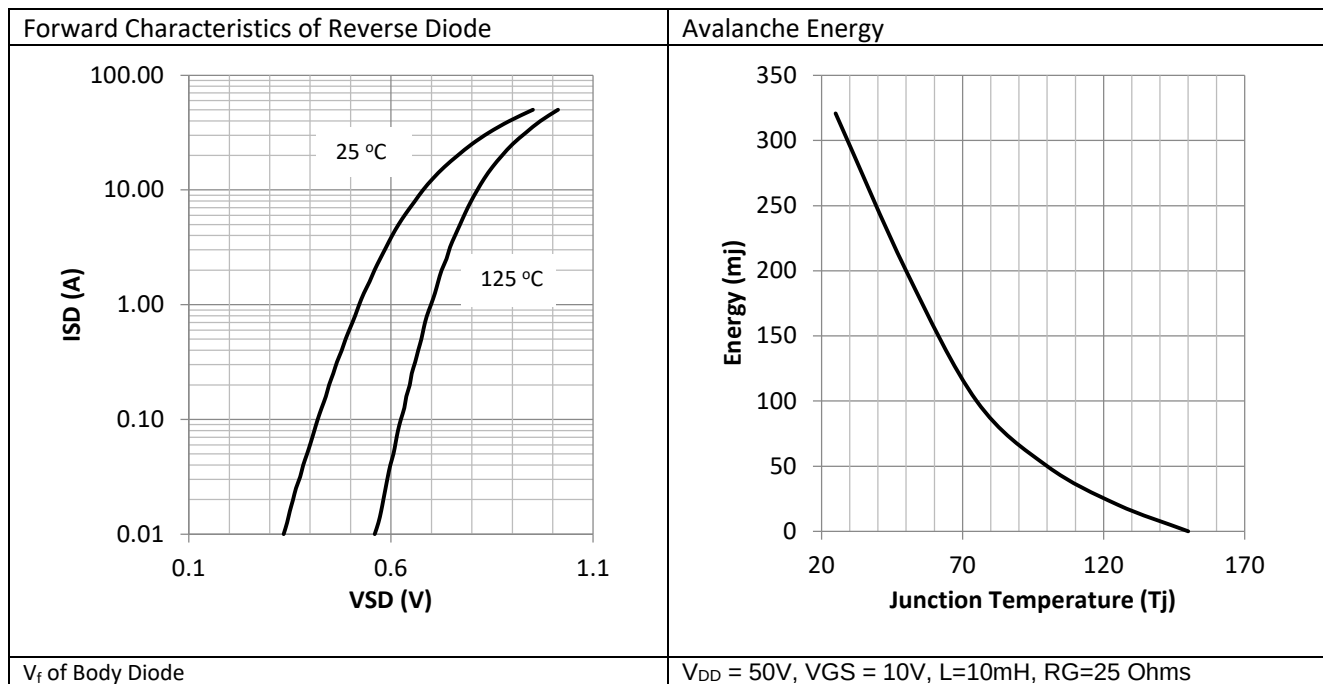
Table 12 Typical Capacitances and Gate Charge

Table 13 Diode Forward Characteristics and Avalanche Energy


Table 14 Drain – Source Breakdown Voltage and Typical Transfer Characteristics

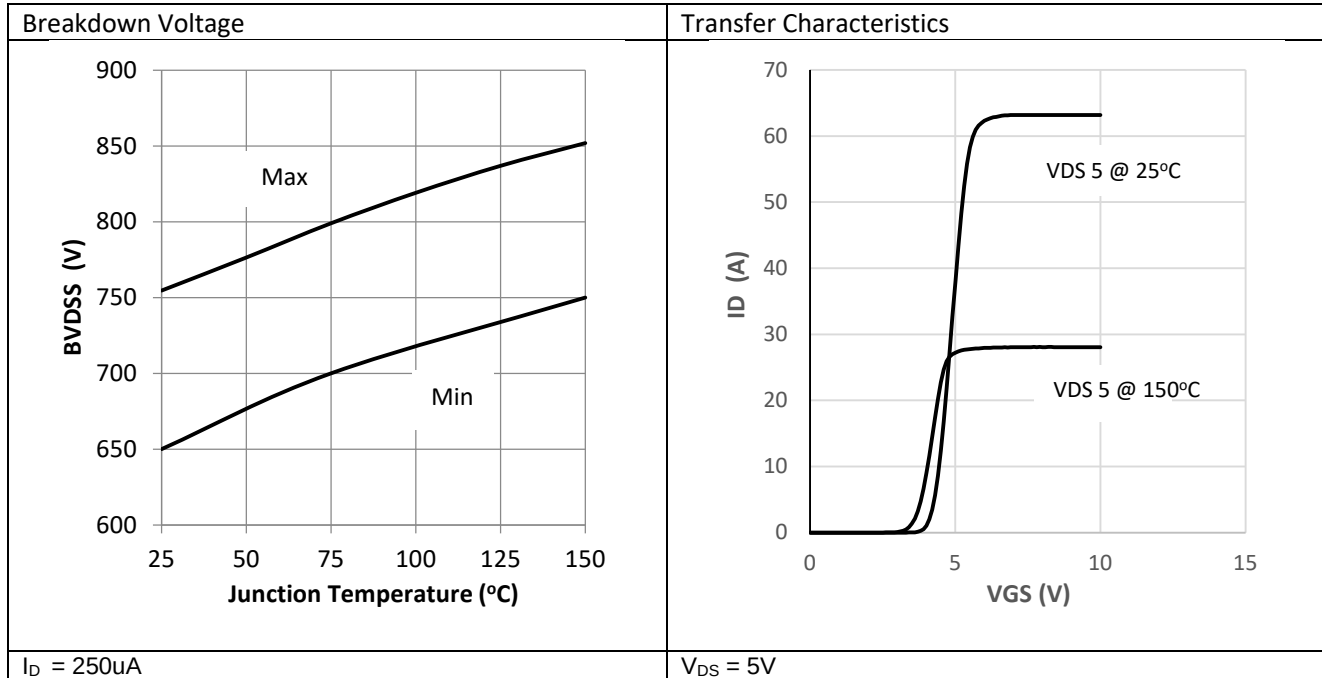


Table 15 Diode Recovery Characteristics

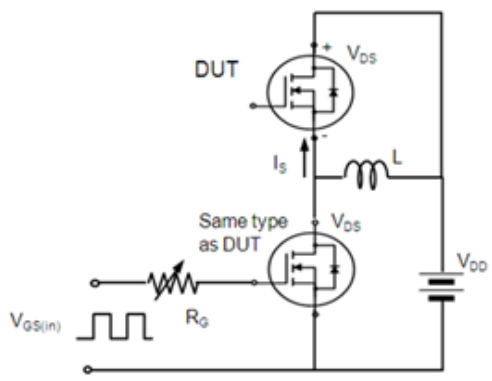
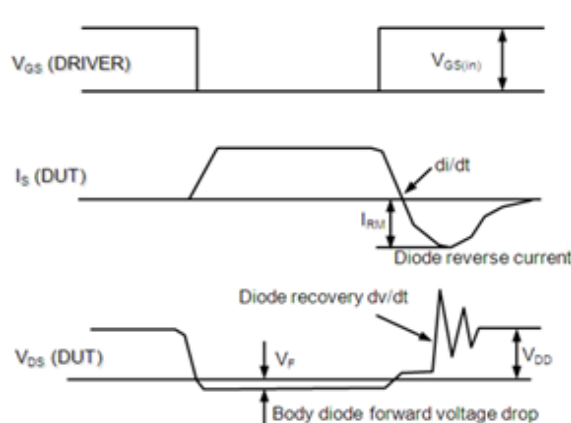
Test Circuit for Diode Recovery	Test Waveform for Diode Recovery
 *. dv/dt controlled by R_G *. I_S controlled by pulse period	

Table 16 Switching Time Characteristics

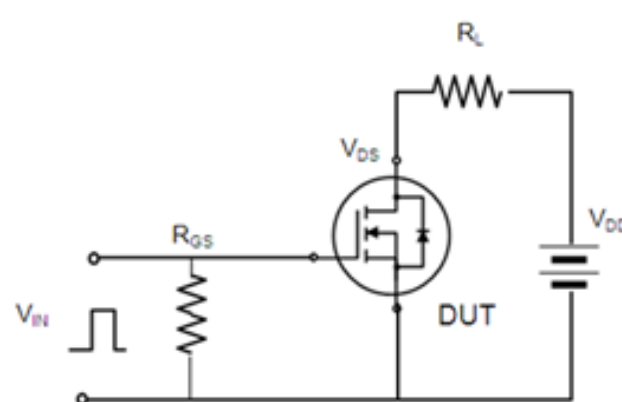
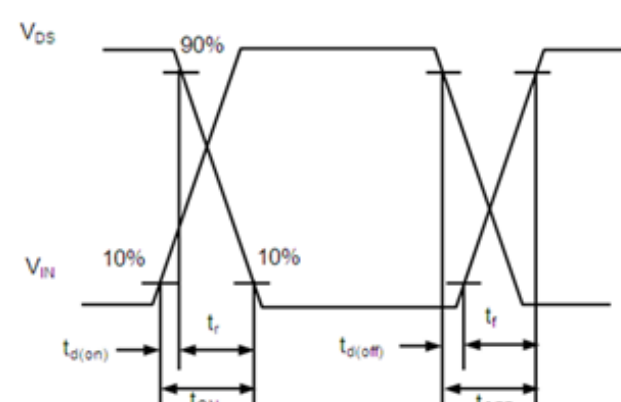
Test Circuit for Switching Time	Test Waveform for Switching Time
	

Table 17 Gate Charge Characteristics

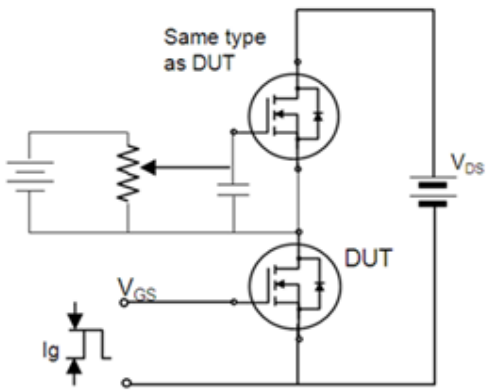
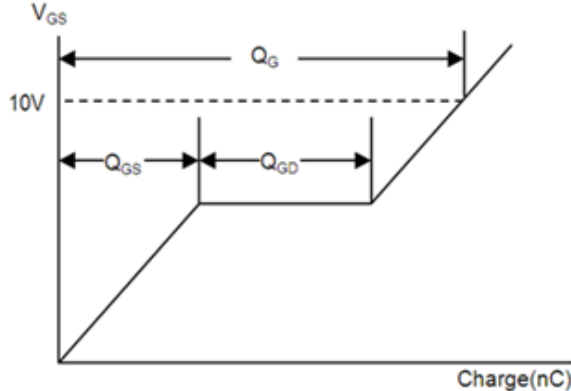
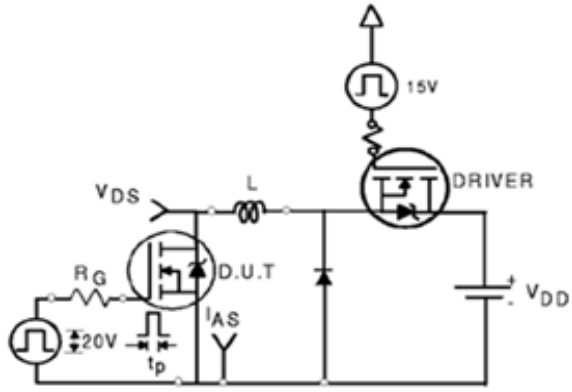
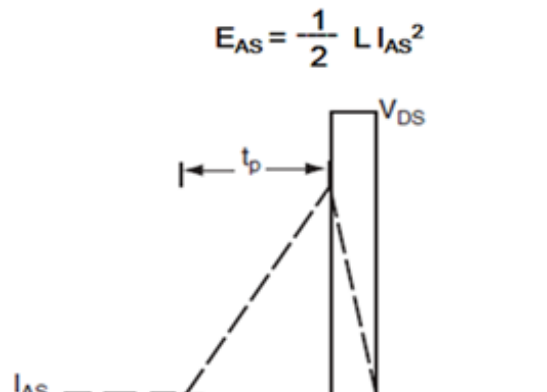
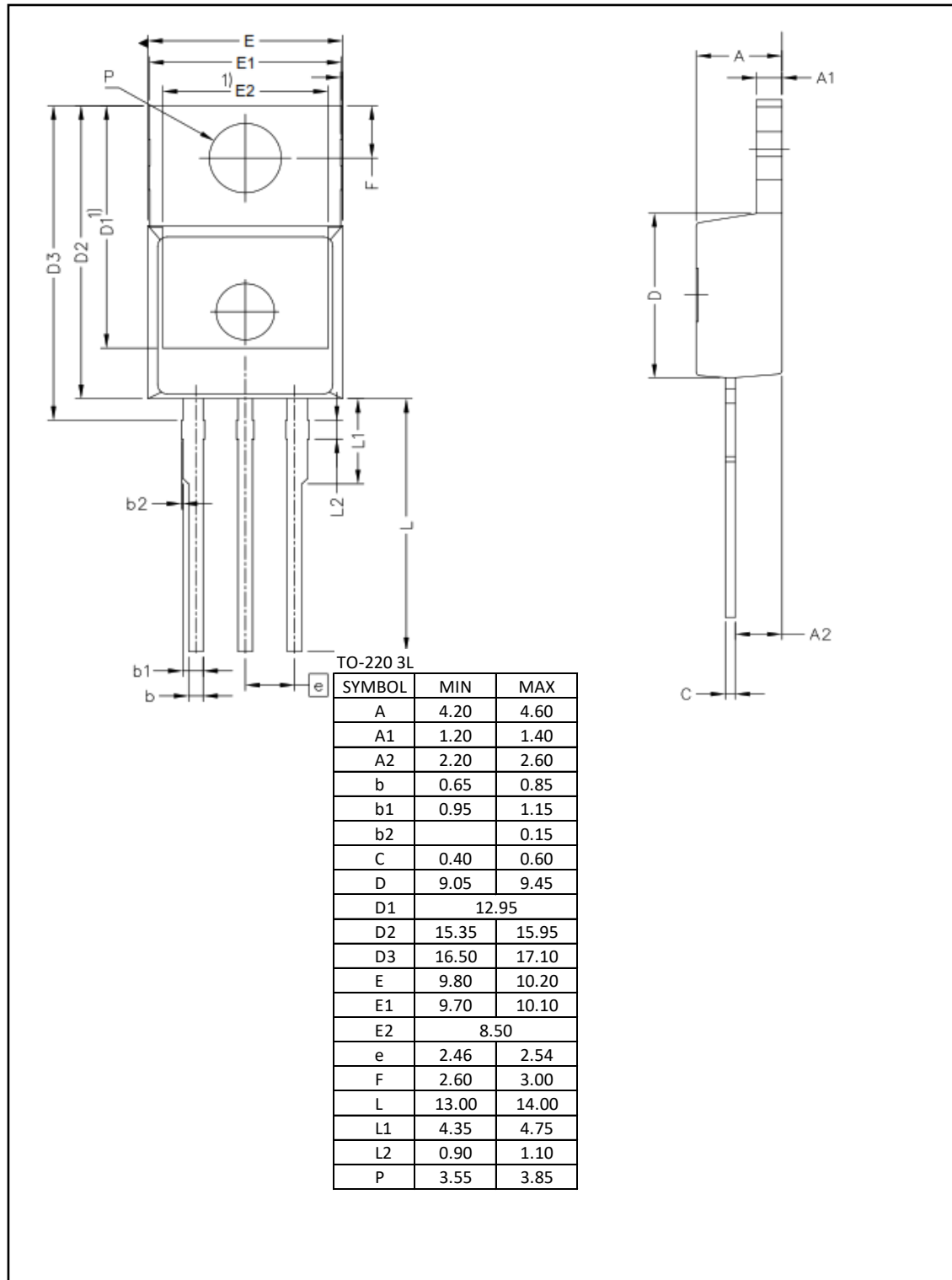
Test Circuit for Gate Charge	Test Waveform for Gate Charge
	

Table 18 Unclamped Inductive Switching Characteristic

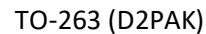
Test Circuit for Unclamped Inductive Switching	Test Waveform for Unclamped Inductive Switching
	

4a) TO-220

D3 Semiconductor TO-220-3L



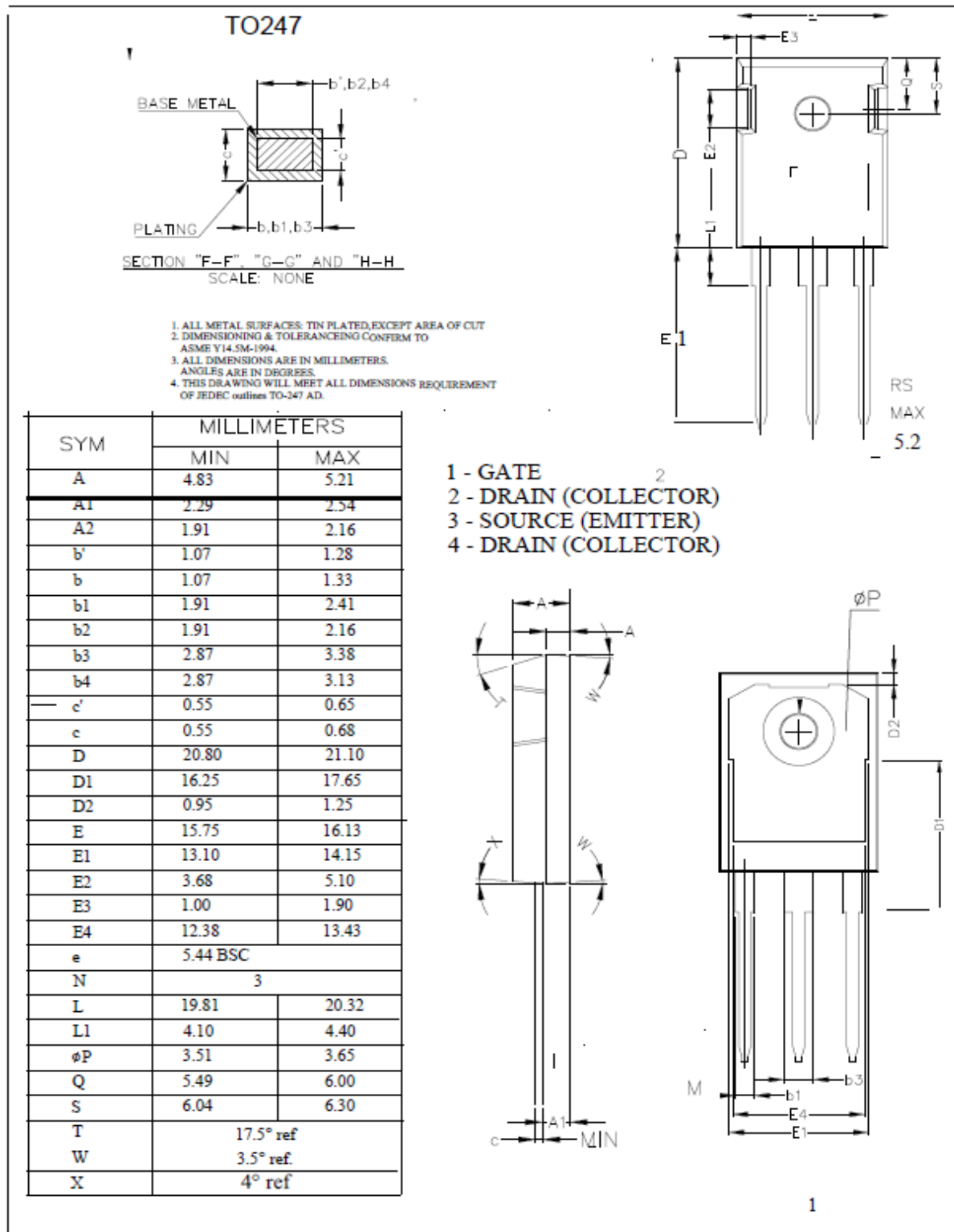
D3 Semiconductor TO-263 (D2PAK)



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

4c) TO-247

D3 Semiconductor TO-247 -3L



Revision History

Revision	Release Date	Comments
1.0	1-Nov-2016	Preliminary Datasheet
1.1	1-July-2017	Updated data tables and added packaging detail
2.3	20-Nov-2017	Added TO247 Package and Designers Datasheet
2.4	11-Dec-2017	Added Test Circuits

Resources

www.d3semi.com

Patents, Copyrights and Trademarks

U.S. and Foreign Patents Pending.

The following are trademarks and service marks owned by D3 Semiconductor:

D3 Semiconductor[®], “Flying D” [®], +FET[™], Defining Precision Power[™].

All trademarks are property of their respective owners. © D3 Semiconductor 2016. All rights reserved

Legal Disclaimer

The information in this document is provided solely regarding D3 Semiconductor (“D3”) products. The information is not a guarantee of performance or characteristics. D3 Semiconductor reserves the right to modify, change, amend, improve or make corrections to this document, and its products, at any time and its sole discretion without prior written consent or notice. No license to any intellectual property rights is granted or implied under this document. D3 Semiconductor disclaims warranties and liabilities of any kind including non-infringement of intellectual property rights of any third party. D3 Semiconductor products may be used in applications such as automotive, military, aerospace, medical or other applications where failure or malfunction may result in personal injury, death or severe property or environmental damage only with express written approval from D3 Semiconductor. Sale of D3 Semiconductor products are subject to D3 Semiconductor’s standard terms and conditions. Products not purchased through D3 Semiconductor’s authorized distributors, agents or sales representatives are void of warranty.

Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9