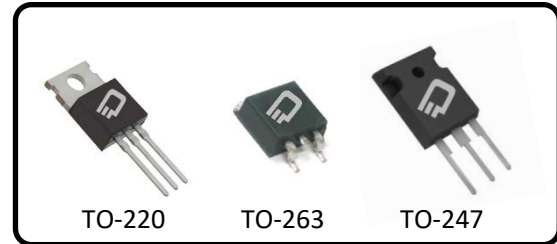


650V, 99mΩ, 31.8 A Super Junction Power MOSFET

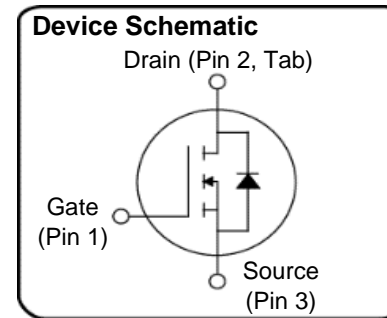
Ordering Information

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.



Features

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

Table 1 Key Parameters

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

Benefits

- LOW CONDUCTION LOSSES
- HIGH EFFICIENCY
- EXCELLENT AVALANCHE PERFORMANCE

Applications

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

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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			31.8	A	$T_C = 25^\circ\text{C}$
				23.7	A	$T_C = 100^\circ\text{C}$
Pulsed drain current	$I_{D, \text{pulse}}$			127	A	$T_C = 25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}			650	mJ	$I_D = 8.7\text{A}; V_{DD} = 50\text{V}, V_{GS} = 10\text{V}, L = 17\text{mH}, R_G = 25\ \Omega$
Avalanche energy, repetitive	E_{AR}			1.0	mJ	$I_D = 8.7\text{A}; V_{DD} = 50\text{V}$
Avalanche current, repetitive	I_{AR}			8.7	A	
MOSFET dv/dt ruggedness	dv/dt			50	V/ns	$V_{DS} = 0 \dots 400\text{V}$
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}			154	W	TO-220, TO-263, TO-247, $T_C = 25^\circ\text{C}$
Storage temperature	T_{stg}	-55		150	$^\circ\text{C}$	
Operating junction temperature	T_j	-55		150	$^\circ\text{C}$	
Mounting torque				60	N-cm	
Continuous diode forward current	I_{SD}			31.8	A	$T_C = 25^\circ\text{C}$
Diode pulse current	$I_{S, \text{pulse}}$			127	A	$T_C = 25^\circ\text{C}$
Reverse diode dv/dt	dv/dt			15	V/ns	$V_{DS} = 0 \dots 400\text{V}, I_{SD} \leq I_S, T_j = 25^\circ\text{C}$
Maximum diode commutation speed	di/dt			500	A/ μs	$V_{DS} = 0 \dots 400\text{V}, I_{SD} \leq I_S, T_j = 25^\circ\text{C}$

Thermal Characteristics

Table 3 Thermal Characteristics

Symbol	Parameter	Values			Unit
		TO-220	TO-263	TO-247	
R _{thC}	Thermal resistance, junction-case	0.81	0.81	0.81	°C/W
R _{thA}	Thermal resistance, junction-ambient	62	62	50	°C/W
R _{thT}	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°C, unless otherwise specified

Table 4

Parameter	Symbol	Values			Unit	Condition
		Min	Typ	Max		
Drain-source breakdown voltage	V _{DSS}	650			V	I _D = 1mA, V _{GS} = 0V
Gate threshold voltage	V _{GS(th)}	2.3	3	3.7	V	
Zero gate voltage drain current	I _{DSS}			1	μA	V _{DS} = 650V, T _C = 25°C
				50		V _{DS} = 650V, T _C = 125°C
Gate-source leakage current	I _{GSS}			100	nA	
Drain-source on-state resistance	R _{DS(on)}		0.062	0.099	Ω	V _{GS} = 10V, I _D = 15.9A, T _C = 25°C
	R _{DS(on)}		0.160			V _{GS} = 10V, I _D = 15.9A, T _C = 150°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} = 100V, f = 1MHz, V _{GS} = 0V
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} = 400V, I _D = 15.9A R _G = 1Ω, V _{GS} = 10V
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

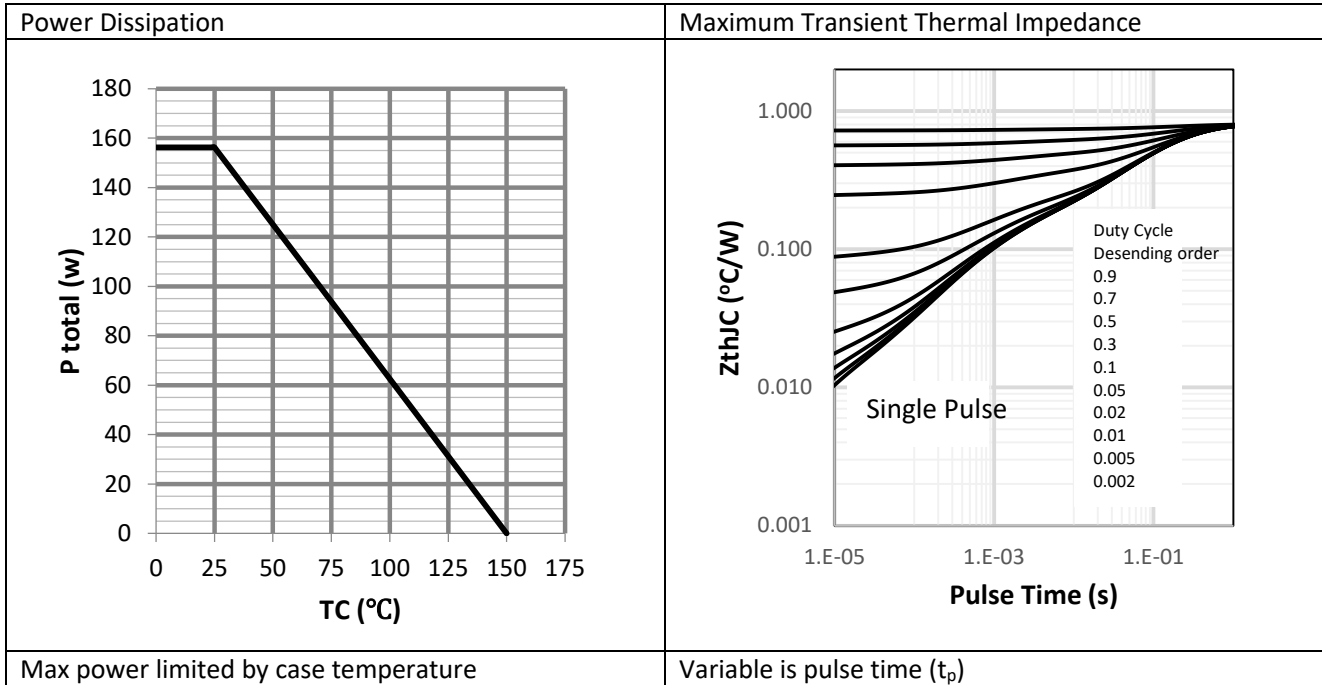


Table 9 Output Characteristics

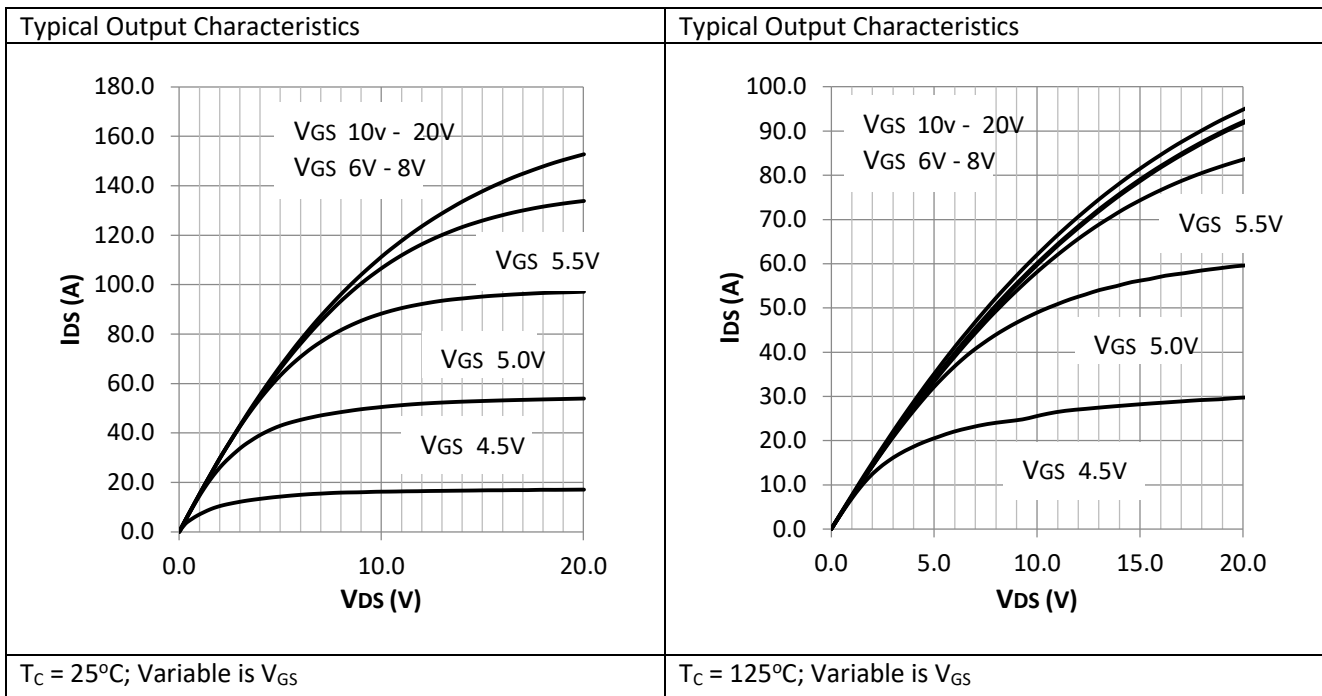


Table 10 Drain-Source Resistance

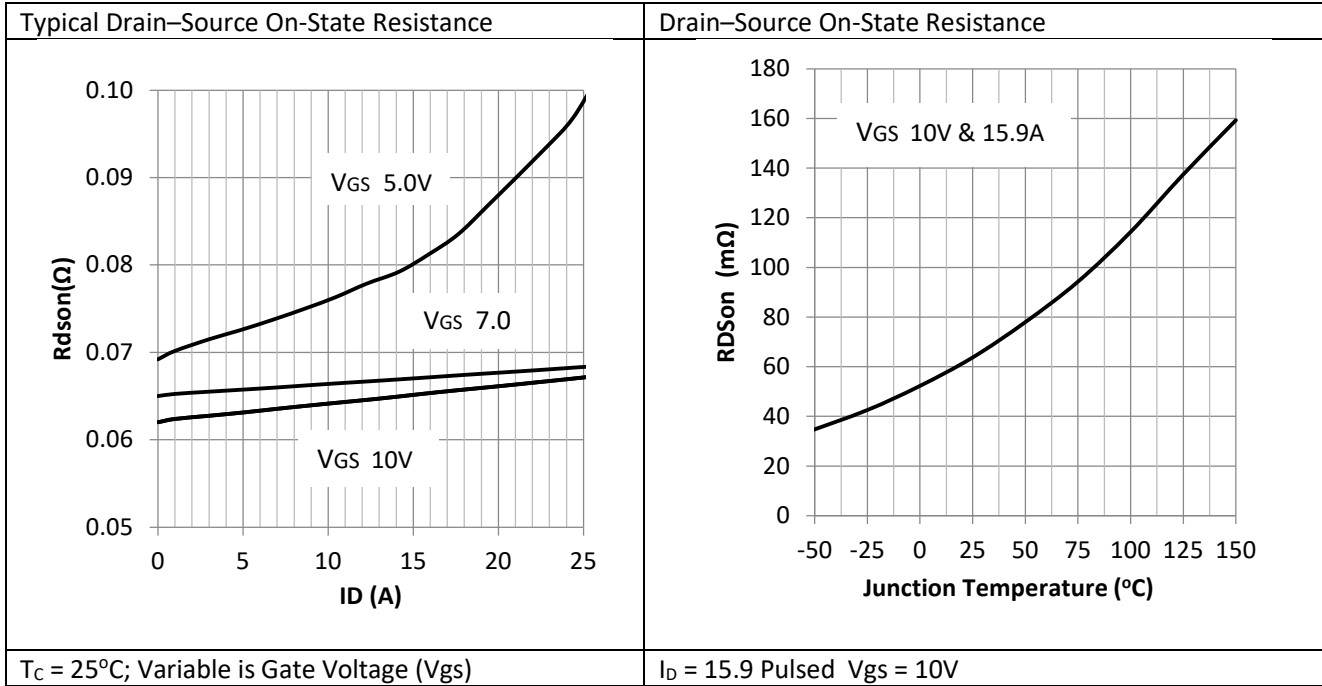


Table 11 Safe Operating Area

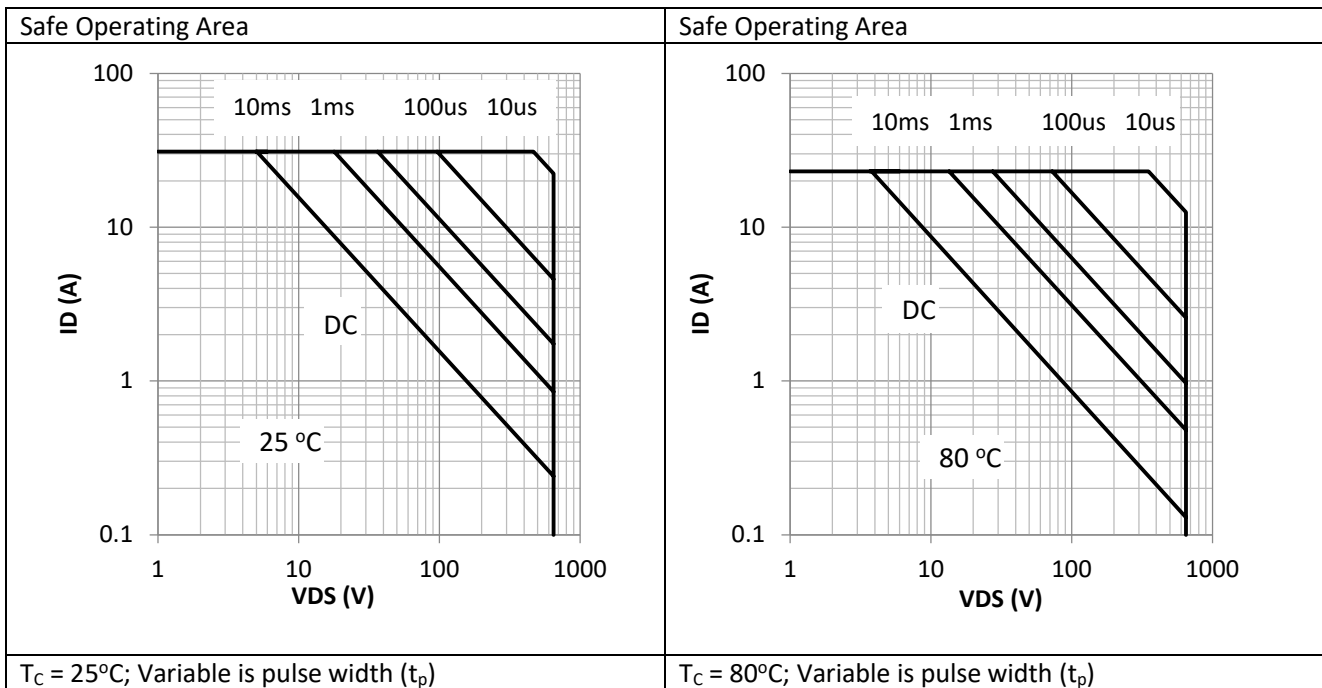


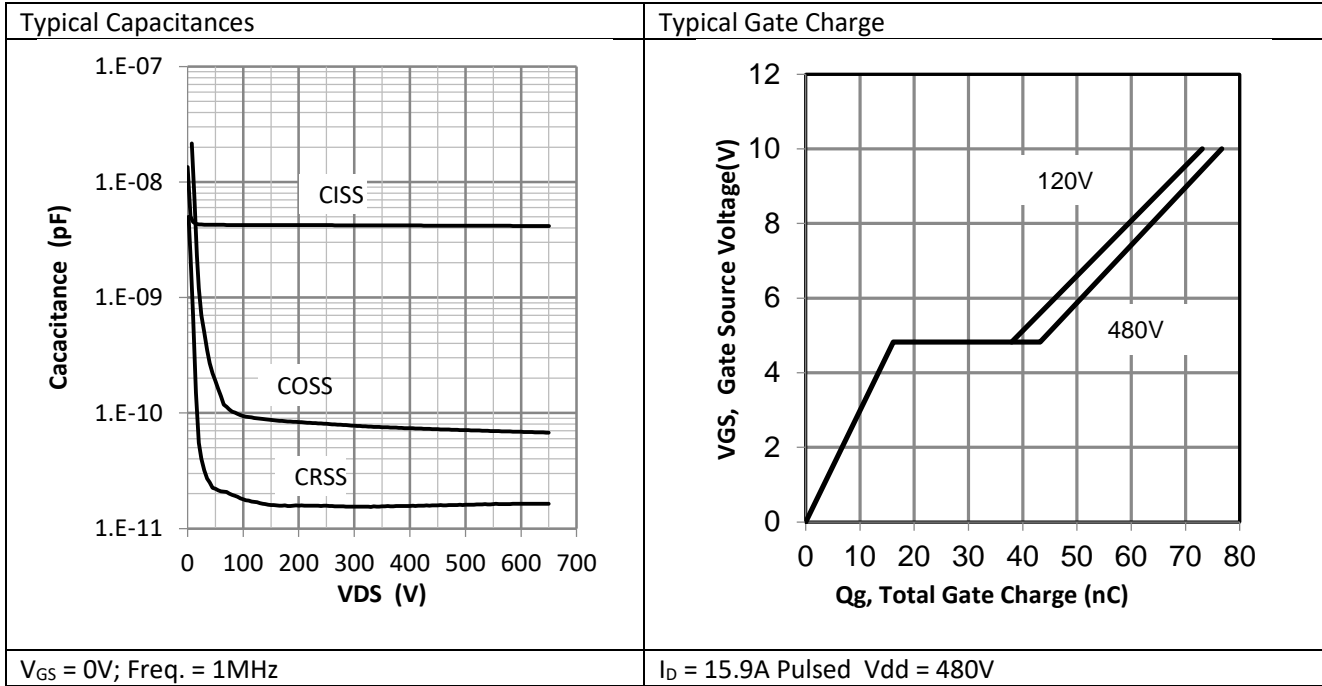
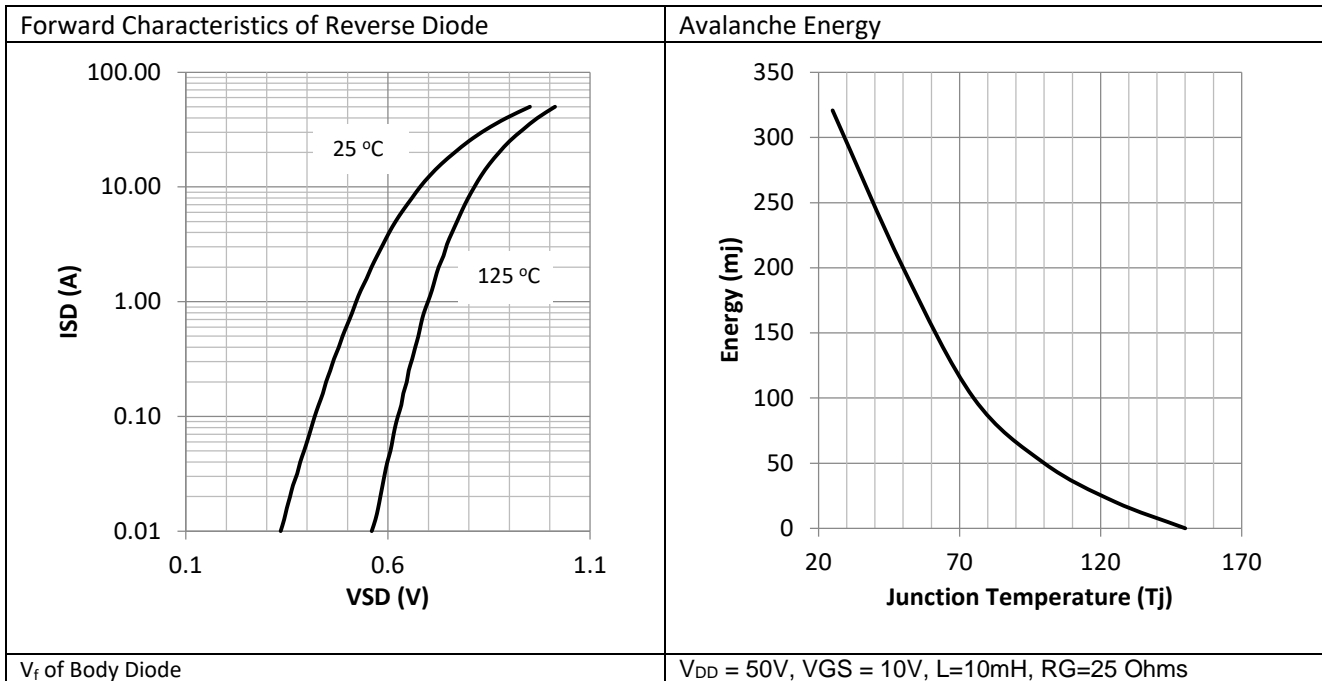
Table 12 Typical Capacitances and Gate Charge

Table 13 Diode Forward Characteristics and Avalanche Energy


Table 14 Drain – Source Breakdown Voltage and Typical Transfer Characteristics

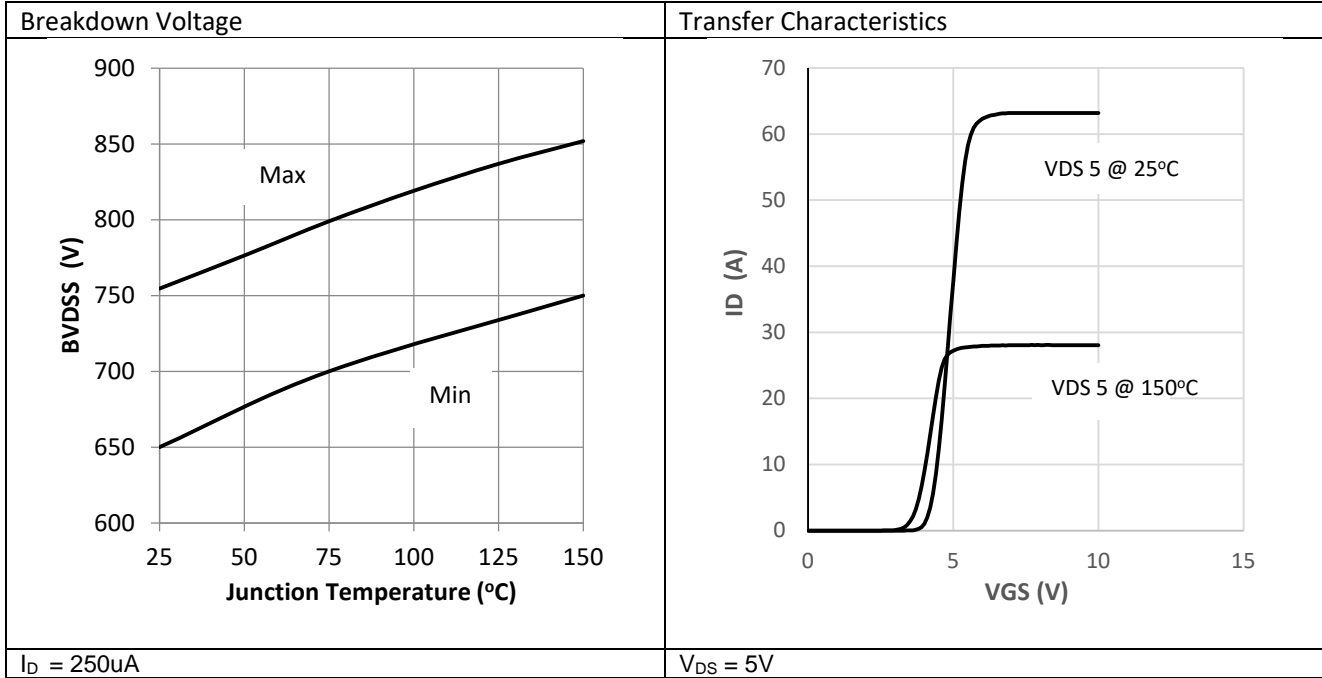


Table 15 Diode Recovery Characteristics

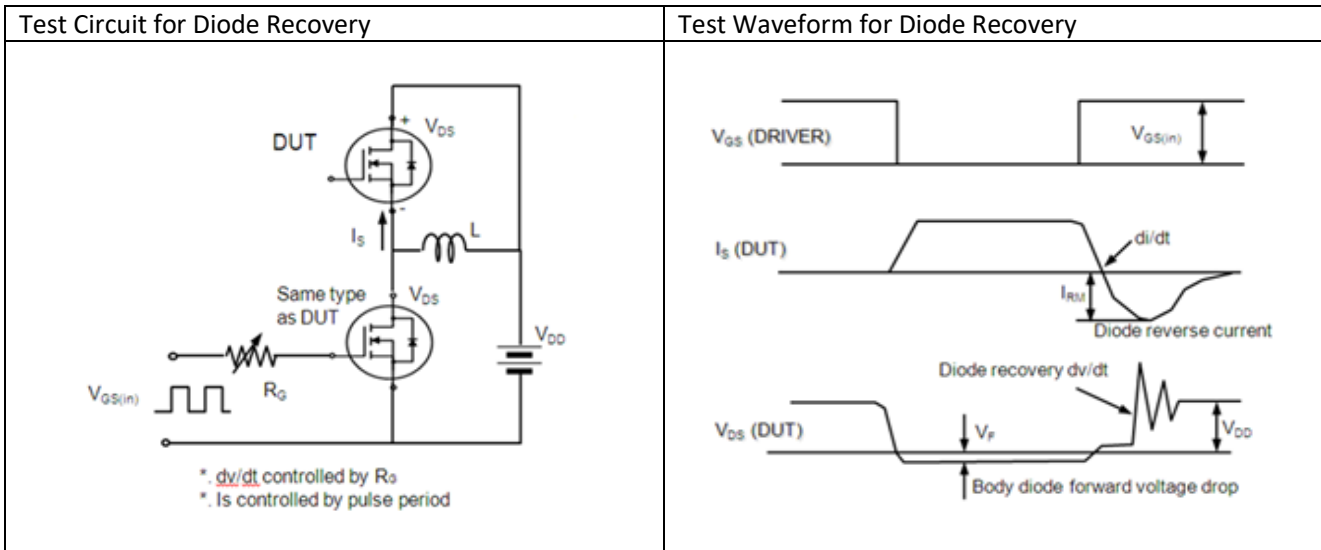


Table 16 Switching Time Characteristics

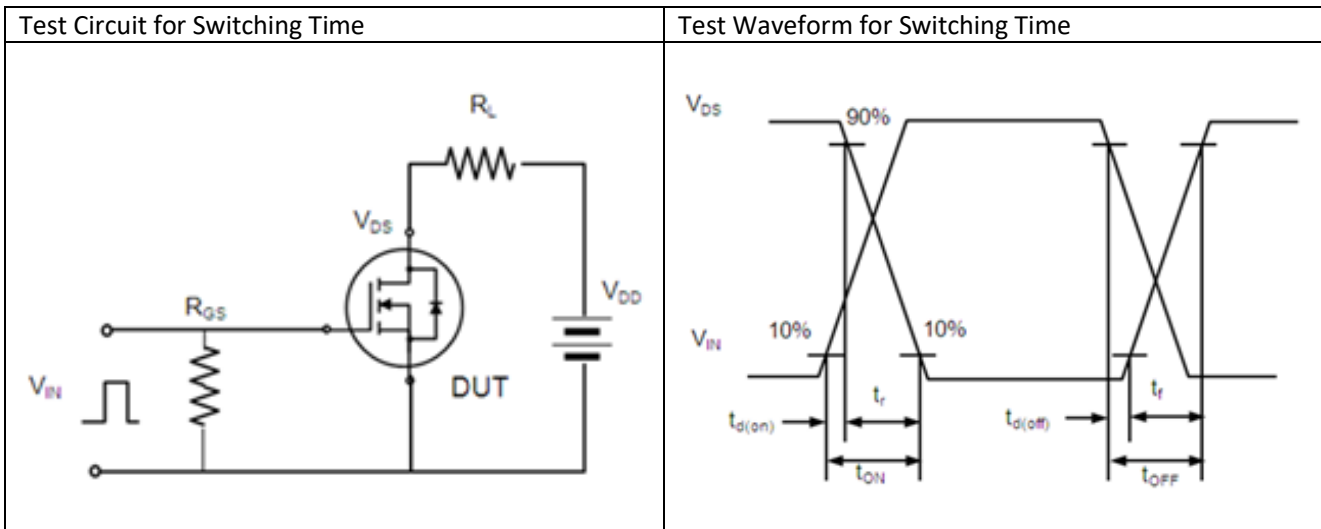


Table 17 Gate Charge Characteristics

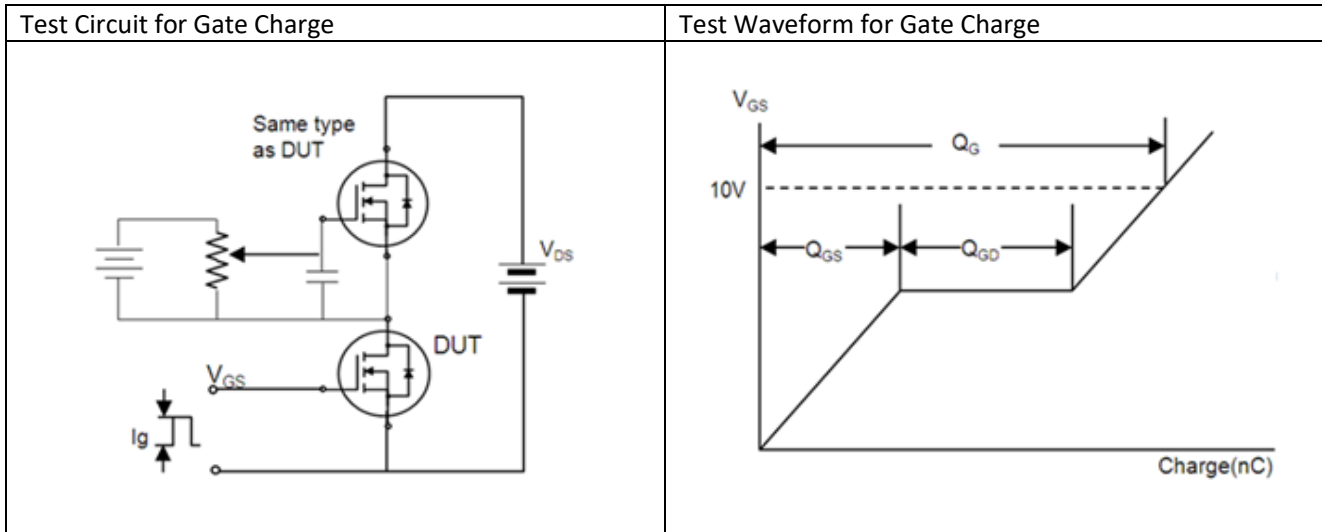
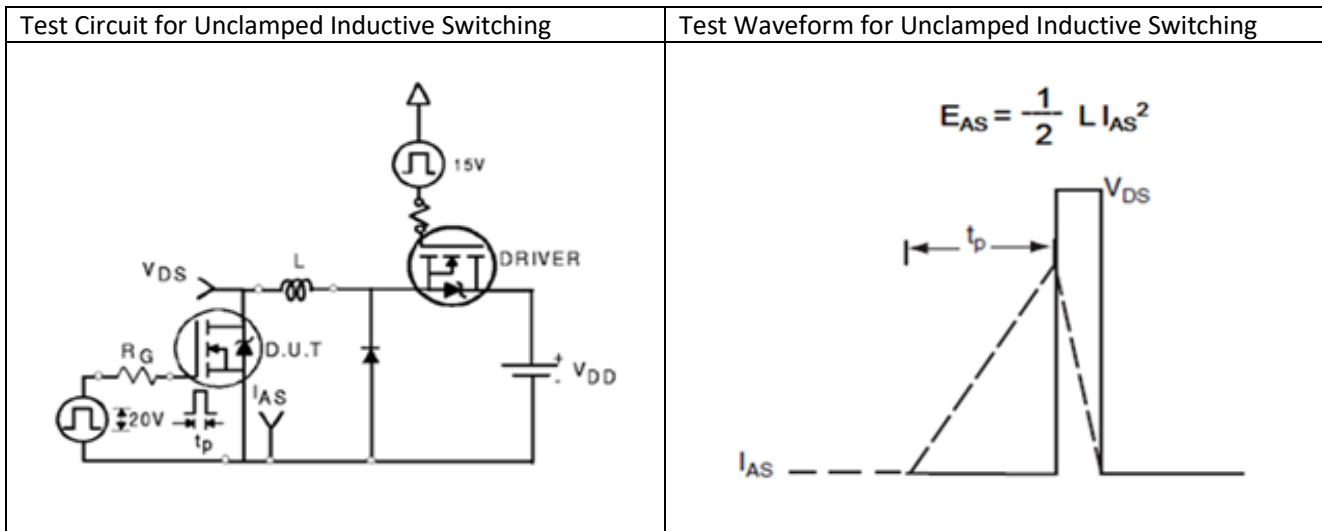


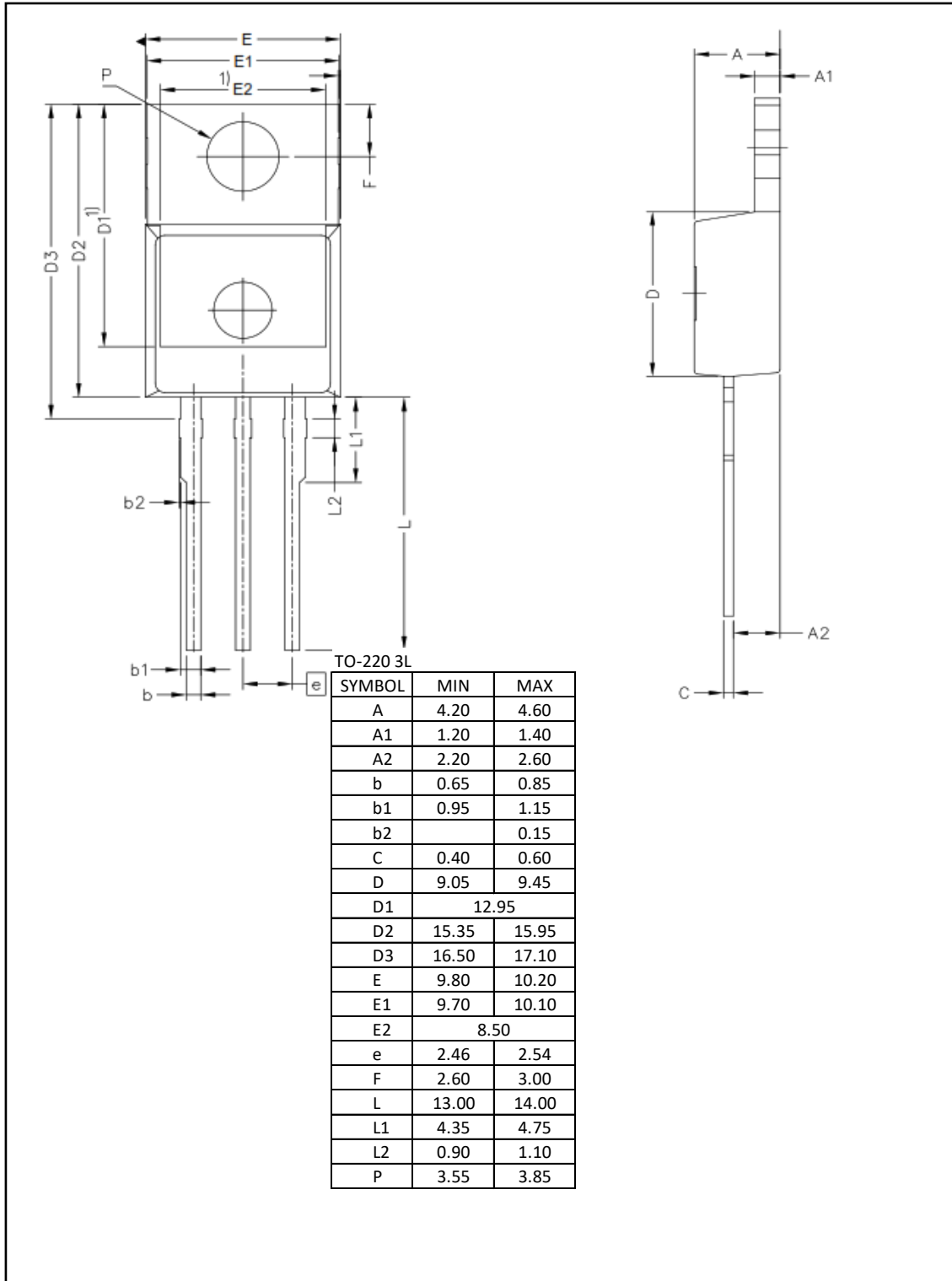
Table 18 Unclamped Inductive Switching Characteristic



Package Outlines

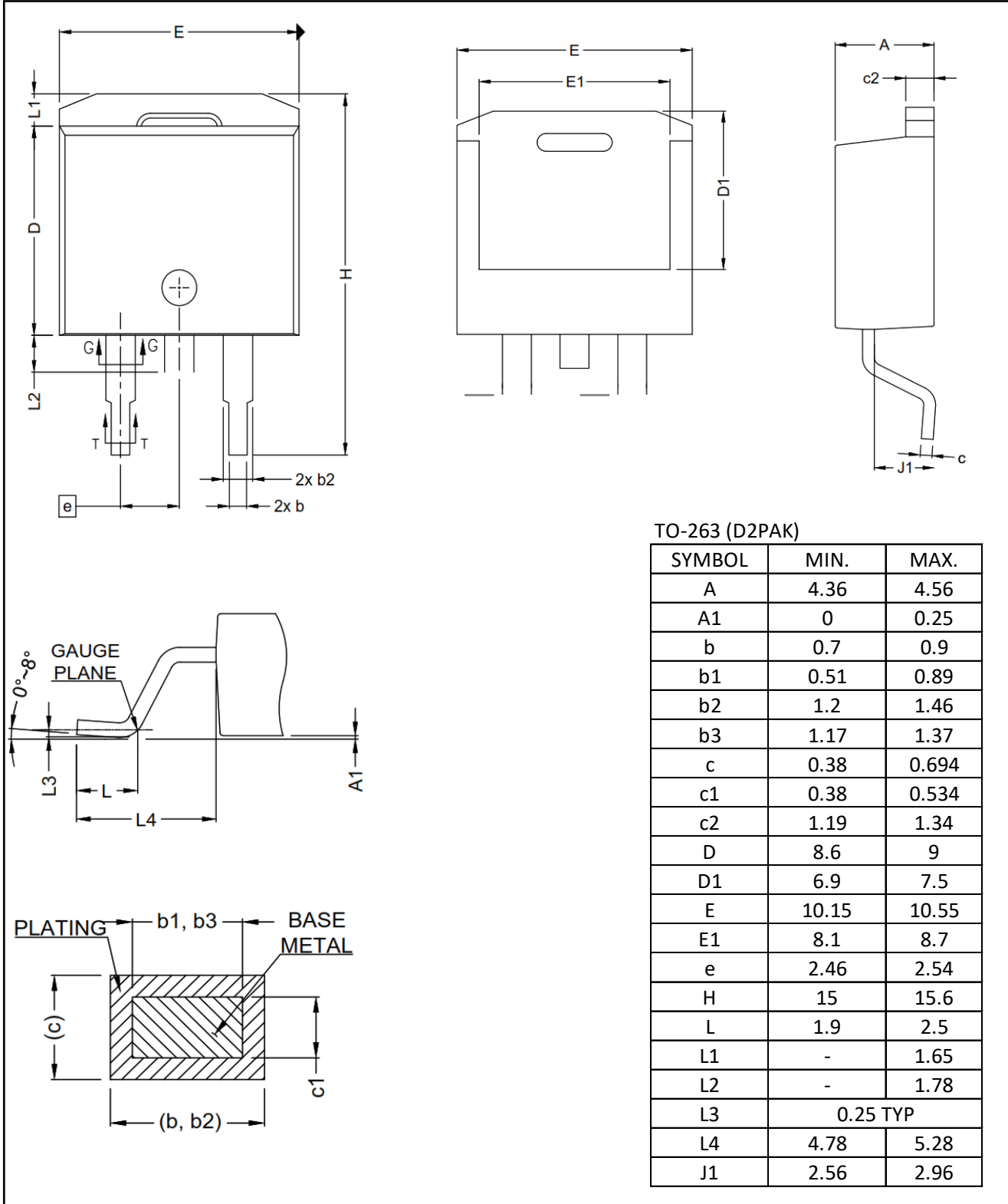
4a) TO-220

D3 Semiconductor TO-220-3L



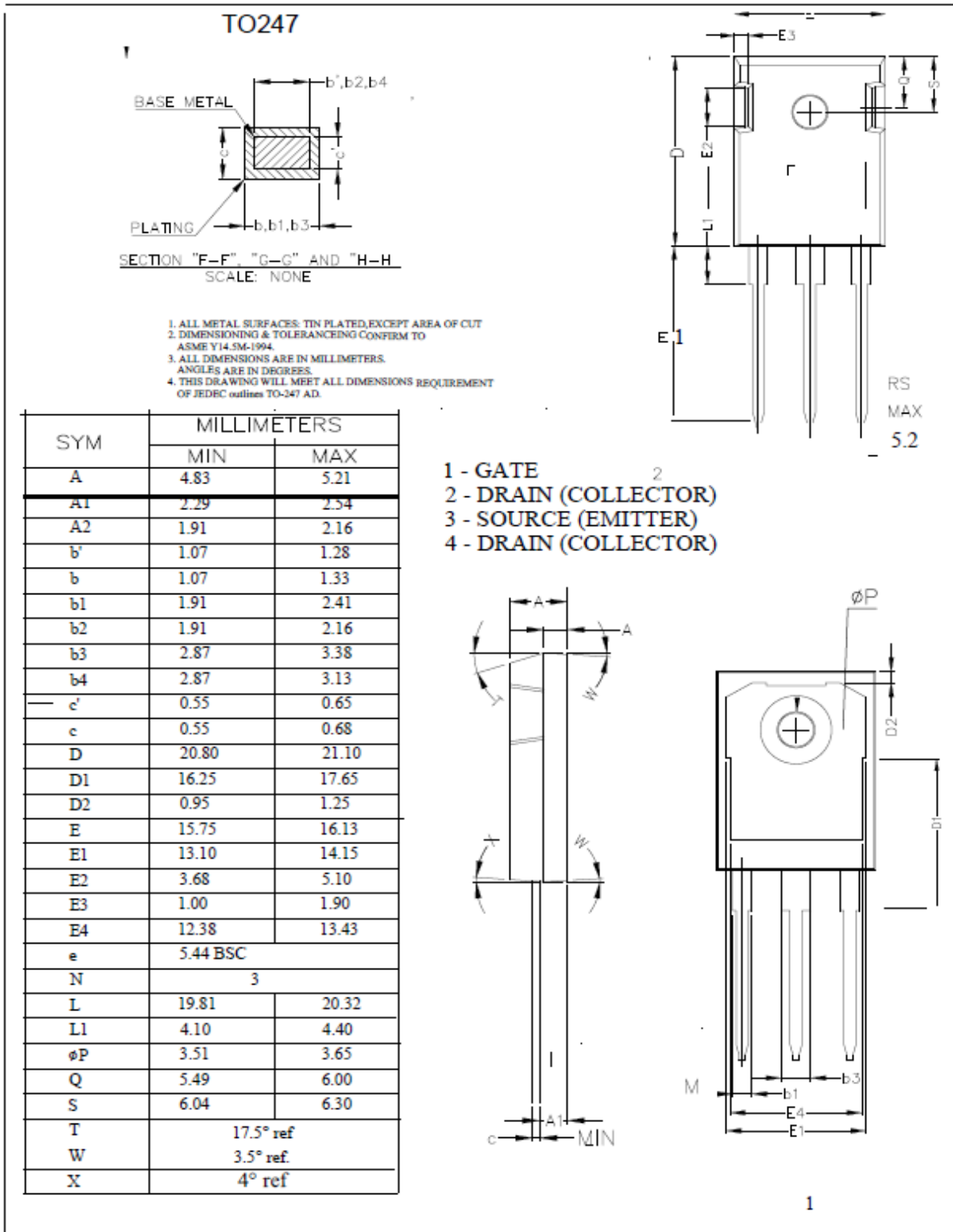
4b) TO-263

D3 Semiconductor TO-263 (D2PAK)



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

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- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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