

N-Channel 500-V (D-S) Super Junction MOSFET



RoHS
COMPLIANT

PRODUCT SUMMARY		
V _{DS} (V) at T _J max.	500	
R _{DS(on)} max. at 25 °C (Ω)	V _{GS} = 10 V	0.243
Q _g max. (nC)	66	
Q _{gs} (nC)	8	
Q _{gd} (nC)	14	
Configuration	Single	

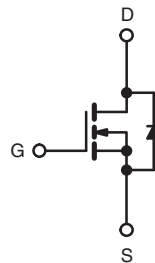
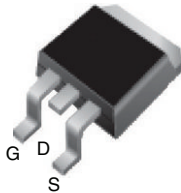
FEATURES

- Low figure-of-merit (FOM) R_{on} x Q_g
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Low gate charge (Q_g)
- Avalanche energy rated (UIS)

APPLICATIONS

- Computing
 - PC silver box / ATX power supplies
- Lighting
 - Two stage LED lighting
- Consumer electronics
- Applications using hard switched topologies
 - Power factor correction (PFC)
 - Two switch forward converter
 - Flyback converter
- Switch mode power supplies (SMPS)

D²PAK (TO-263)




N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V _{DS}	500	V	
Gate-Source Voltage	V _{GS}	± 30		
Continuous Drain Current (T _J = 150 °C)	V _{GS} at 10 V	T _C = 25 °C	14.5	A
		T _C = 100 °C	9.2	
Pulsed Drain Current ^a	I _{DM}	28		
Linear Derating Factor		1.25	W/°C	
Single Pulse Avalanche Energy ^b	E _{AS}	136	mJ	
Maximum Power Dissipation	P _D	156	W	
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-55 to +150	°C	
Drain-Source Voltage Slope	dV/dt	V _{DS} = 0 V to 80 % V _{DS}	70	V/ns
Reverse Diode dV/dt ^d		27		
Soldering Recommendations (Peak Temperature) ^c	for 10 s	300	°C	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- V_{DD} = 50 V, starting T_J = 25 °C, L = 28.2 mH, R_g = 25 Ω, I_{AS} = 3.1 A.
- 1.6 mm from case.
- I_{SD} ≤ I_D, dI/dt = 100 A/μs, starting T_J = 25 °C.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R _{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	R _{thJC}	-	0.8	

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	500	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA	-	0.62	-	V/°C
Gate-Source Threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	2.0	-	4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V	-	-	± 100	nA
		V _{GS} = ± 30 V	-	-	± 1	μA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 500 V, V _{GS} = 0 V	-	-	10	μA
		V _{DS} = 400 V, V _{GS} = 0 V, T _J = 125 °C	-	-	25	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V, I _D = 7.5 A	-	0.243	0.280	Ω
Forward Transconductance	g _{fs}	V _{DS} = 30 V, I _D = 7.5 A	-	3.9	-	S
Dynamic						
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz	-	1162	-	pF
Output Capacitance	C _{oss}		-	51	-	
Reverse Transfer Capacitance	C _{rss}		-	7	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}		-	55	-	
Effective Output Capacitance, Time Related ^b	C _{o(tr)}	V _{DS} = 0 V to 400 V, V _{GS} = 0 V	-	164	-	
Total Gate Charge	Q _g	V _{GS} = 10 V, I _D = 7.5 A, V _{DS} = 400 V	-	33	66	nC
Gate-Source Charge	Q _{gs}		-	8	-	
Gate-Drain Charge	Q _{gd}		-	14	-	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 400 V, I _D = 12 A, V _{GS} = 10 V, R _g = 9.1 Ω	-	15	30	ns
Rise Time	t _r		-	24	48	
Turn-Off Delay Time	t _{d(off)}		-	34	68	
Fall Time	t _f		-	18	36	
Gate Input Resistance	R _g		f = 1 MHz, open drain	-	0.85	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	14.5	A
Pulsed Diode Forward Current	I _{SM}		-	-	28	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 7.5 A, V _{GS} = 0 V	-	-	1.2	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S = 7.5 A, di/dt = 100 A/μs, V _R = 25 V	-	265	-	ns
Reverse Recovery Charge	Q _{rr}		-	3.2	-	μC
Reverse Recovery Current	I _{RRM}		-	23	-	A

Notes

- a. C_{oss(er)} is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}.
b. C_{oss(tr)} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

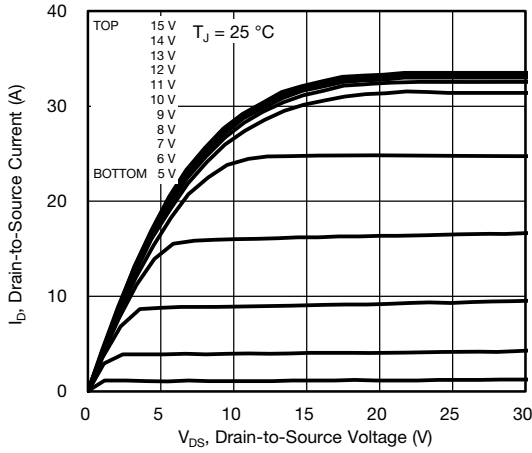


Fig. 1 - Typical Output Characteristics

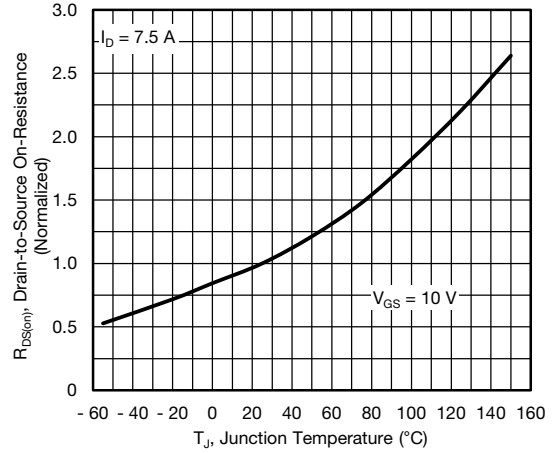


Fig. 4 - Normalized On-Resistance vs. Temperature

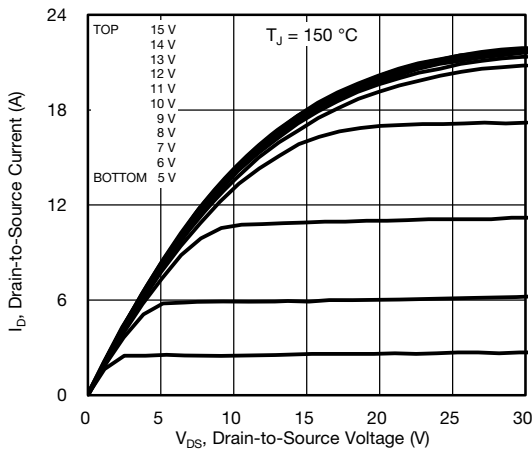


Fig. 2 - Typical Output Characteristics

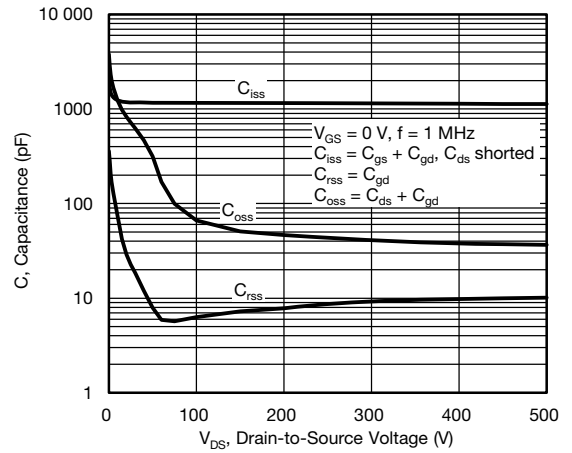


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

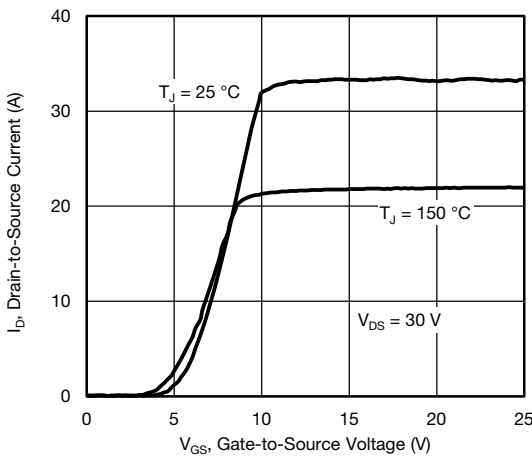


Fig. 3 - Typical Transfer Characteristics

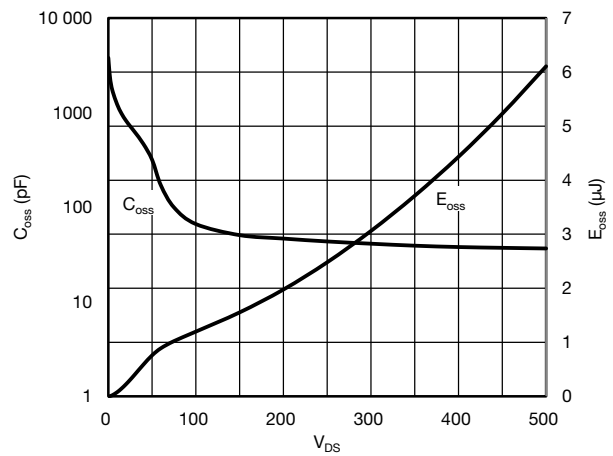


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}

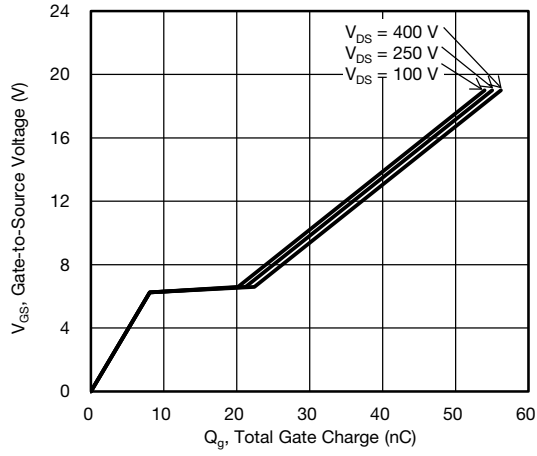


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

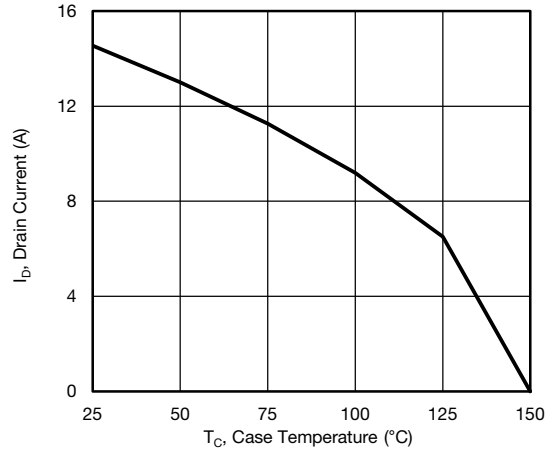


Fig. 10 - Maximum Drain Current vs. Case Temperature

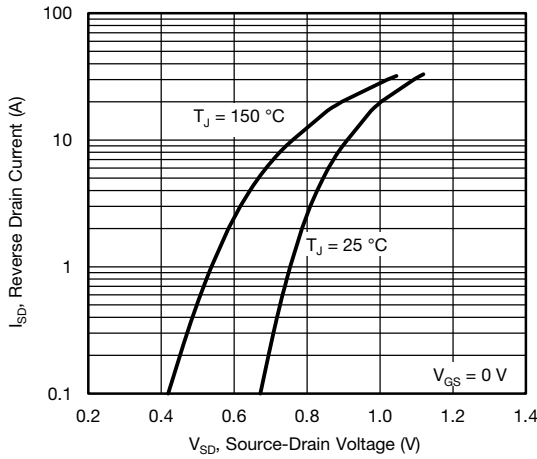


Fig. 8 - Typical Source-Drain Diode Forward Voltage

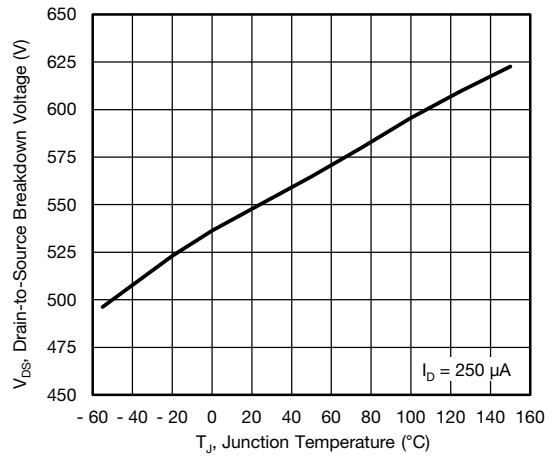


Fig. 11 - Temperature vs. Drain-to-Source Voltage

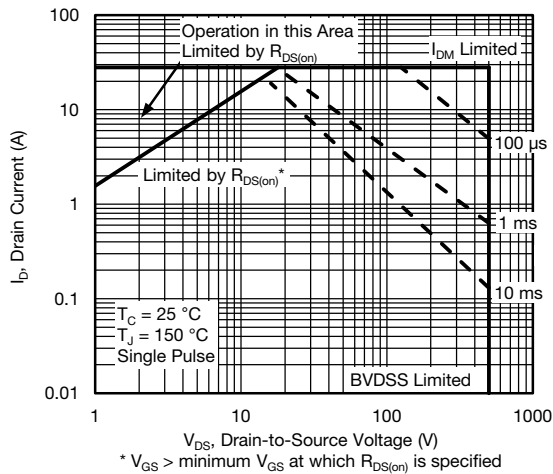


Fig. 9 - Maximum Safe Operating Area

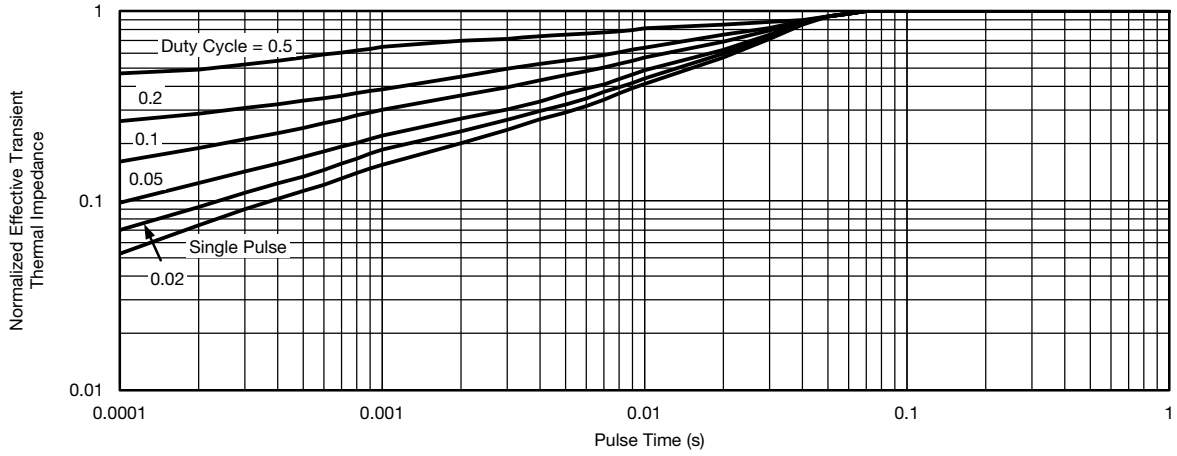


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

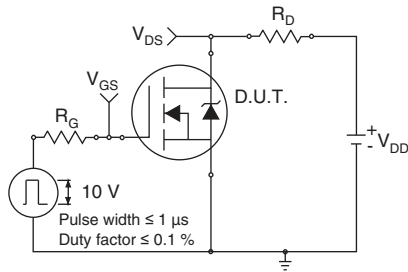


Fig. 13 - Switching Time Test Circuit

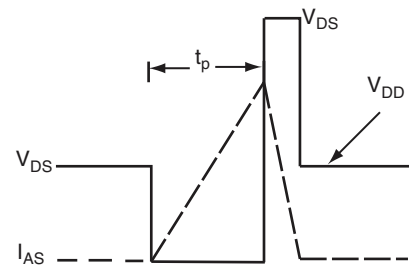


Fig. 16 - Unclamped Inductive Waveforms

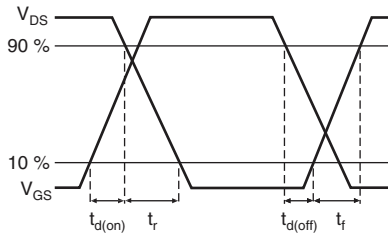


Fig. 14 - Switching Time Waveforms

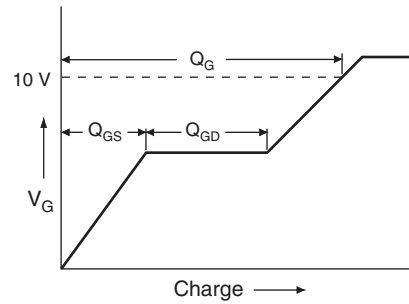


Fig. 17 - Basic Gate Charge Waveform

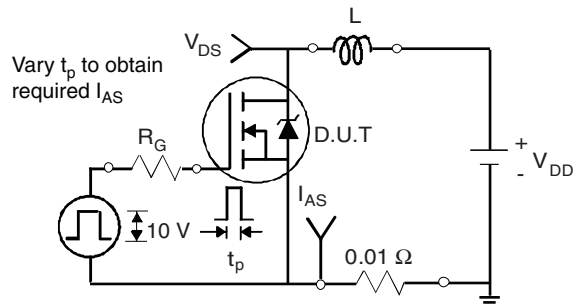


Fig. 15 - Unclamped Inductive Test Circuit

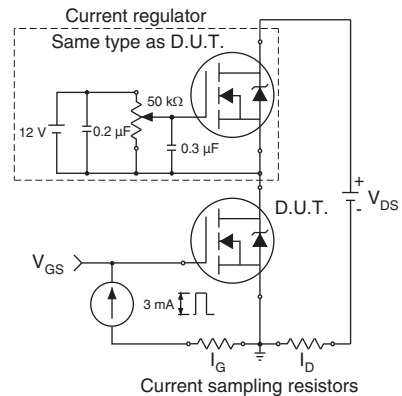
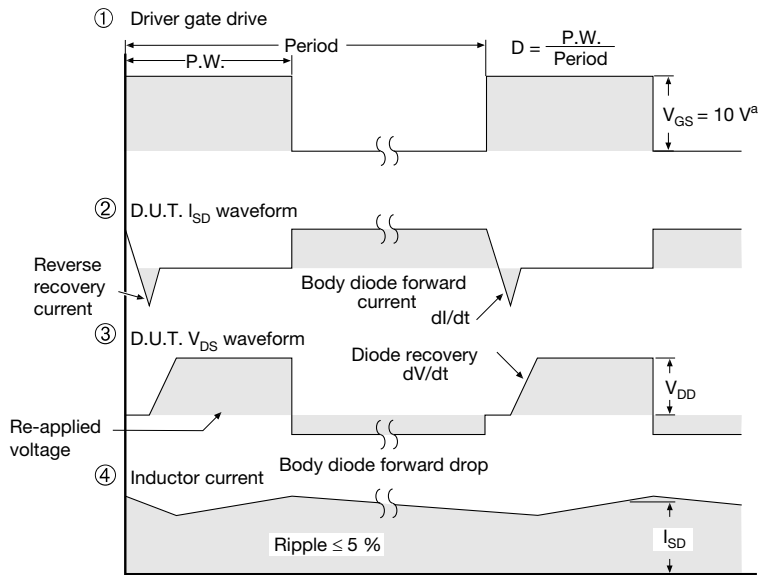
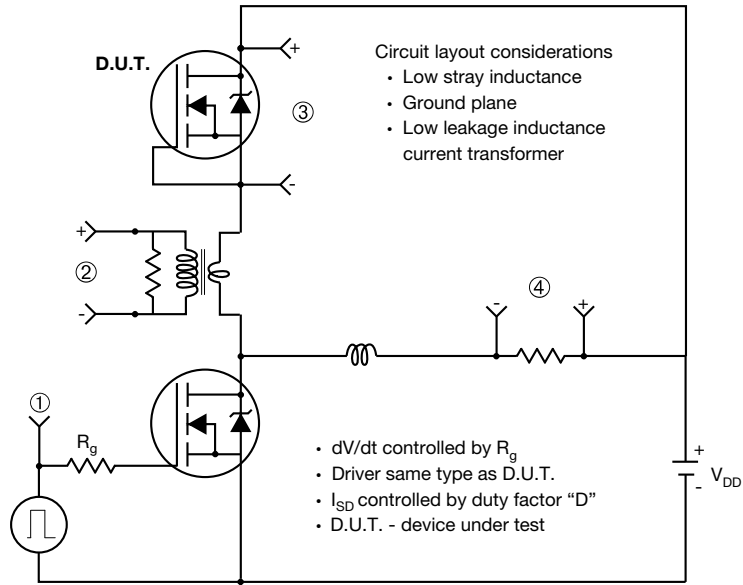


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

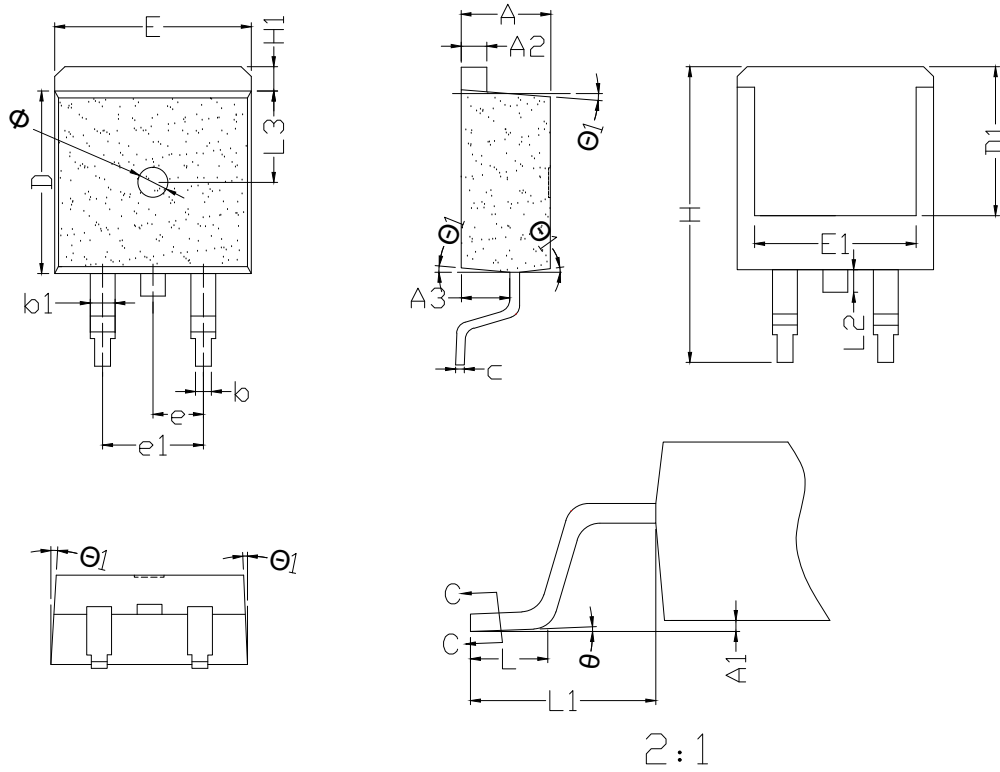


Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 19 - For N-Channel

TO-263 PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	TYP	MAX	SYMBOL	MIN	TYP	MAX
A	4.10	4.50	4.80	e	2.35	2.54	2.75
A1	0.00	0.10	0.30	e1	5.08REF		
A2	1.10	1.30	1.50	H	14.50	15.15	16.00
A3	2.15	2.50	3.10	H1	1.00	1.28	1.75
b	0.60	0.80	1.05	L	1.80	2.23	2.90
b1	1.05	1.33	1.50	L1	4.30	4.75	5.50
c	0.33	0.50	0.66	L2	1.00	1.30	1.85
D	8.40	9.20	9.60	L3	0.90	4.65	9.00
D1	7.50REF			ϕ	0°	2°	5°
E	9.60	10.02	10.80	ϕ_1	2°	-	7°
E1	7.60	9.88	10.30	Φ	1.5BSC		

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