

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

PRODUCT SUMMARY		
V _{DS} (V) at T _J max.	500	
R _{DS(on)} at 25 °C (Ω)	V _{GS} = 10 V	0.115
Q _g (Max.) (nC)	86	
Q _{gs} (nC)	14	
Q _{gd} (nC)	25	
Configuration	Single	

FEATURES

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

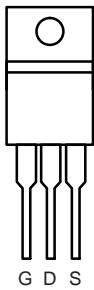


RoHS
COMPLIANT
HALOGEN
FREE

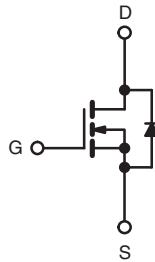
APPLICATIONS

- Hard switched topologies
- Power factor correction power supplies (PFC)
- Switch mode power supplies (SMPS)
 - PC silver box / ATX power supplies
- Computing
 - Two stage LED lighting

TO-220AB



Top View




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	30	A
		T _C = 100 °C	18	
Pulsed Drain Current ^a	I _{DM}		105	
Linear Derating Factor			0.2	W/°C
Single Pulse Avalanche Energy ^b	E _{AS}		273	mJ
Maximum Power Dissipation	P _D		280	W
Operating Junction and Storage Temperature Range	T _J , T _{stg}		-55 to +150	°C
Drain-Source Voltage Slope	V _{DS} = 0 V to 80 % V _{DS}		65	V/ns
Reverse Diode dV/dt ^d			25	
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} = 4.4 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}	-	40	°C/W
Maximum Junction-to-Case (Drain)	R _{thJC}	-	0.5	

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		500	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.59	-	V/ $^\circ\text{C}$
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	± 1	μA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	μA
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	25	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 12\text{ A}$	-	0.115	-	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 30\text{ V}, I_D = 12\text{ A}$		-	6.6	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = 100\text{ V},$ $f = 1\text{ MHz}$		-	1980	-	pF
Output Capacitance	C_{oss}			-	105	-	
Reverse Transfer Capacitance	C_{rss}			-	8	-	
Effective Output Capacitance, Energy Related ^a	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		-	105	-	pF
Effective Output Capacitance, Time Related ^b	$C_{o(tr)}$			-	285	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 12\text{ A}, V_{DS} = 400\text{ V}$	-	57	86	nC
Gate-Source Charge	Q_{gs}			-	14	-	
Gate-Drain Charge	Q_{gd}			-	25	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 12\text{ A}$ $R_g = 9.1\text{ }\Omega, V_{GS} = 10\text{ V}$		-	19	38	ns
Rise Time	t_r			-	36	72	
Turn-Off Delay Time	$t_{d(off)}$			-	57	86	
Fall Time	t_f			-	29	58	
Gate Input Resistance	R_g	$f = 1\text{ MHz}, \text{open drain}$		-	0.56	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	12	A
Pulsed Diode Forward Current	I_{SM}			-	-	50	
Diode Forward Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 16.5\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S,$ $dI/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$		-	338	-	ns
Reverse Recovery Charge	Q_{rr}			-	5.3	-	μC
Reverse Recovery Current	I_{RRM}			-	29	-	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)

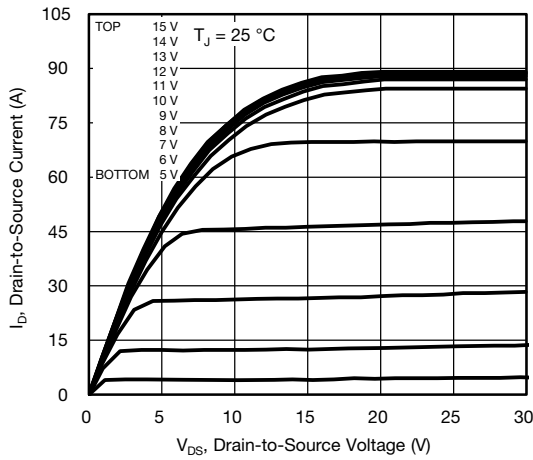


Fig. 1 - Typical Output Characteristics

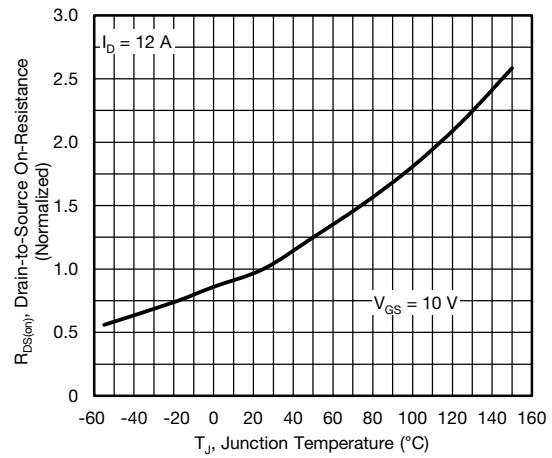


Fig. 4 - Normalized On-Resistance vs. Temperature

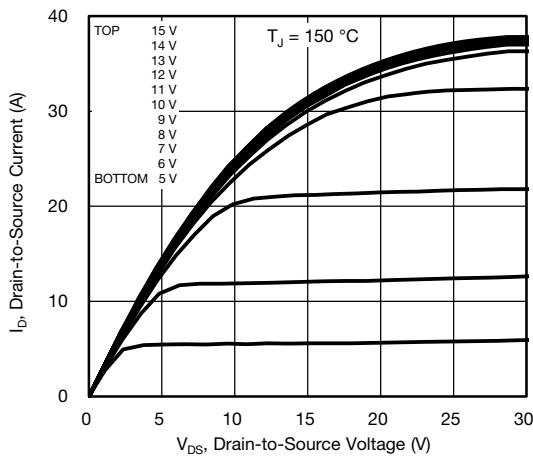


Fig. 2 - Typical Output Characteristics

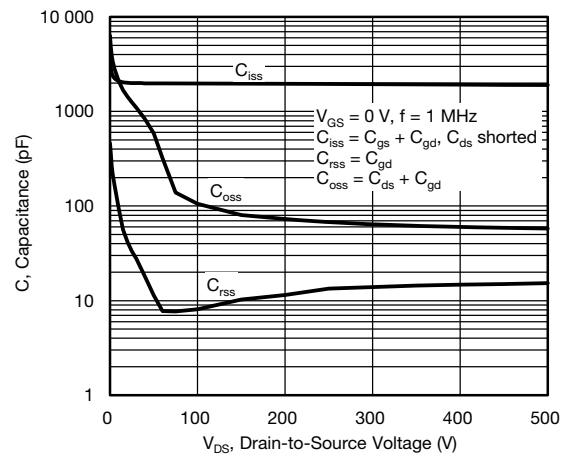


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

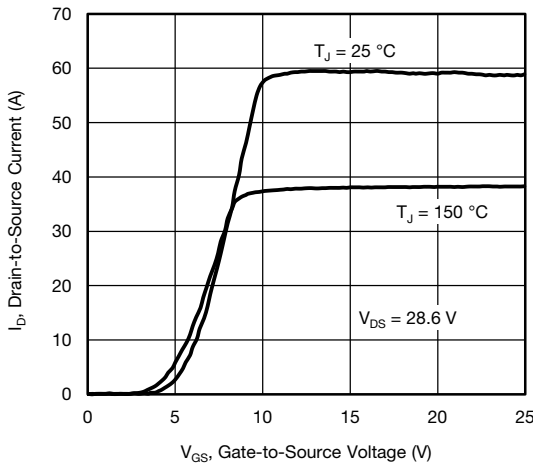


Fig. 3 - Typical Transfer Characteristics

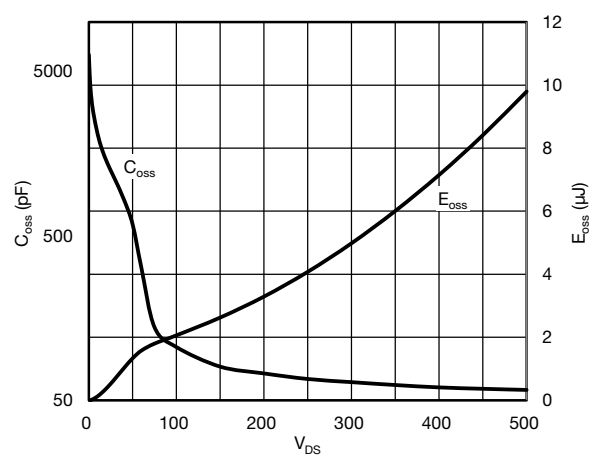


Fig. 6 - Coss and Eoss vs. Vds

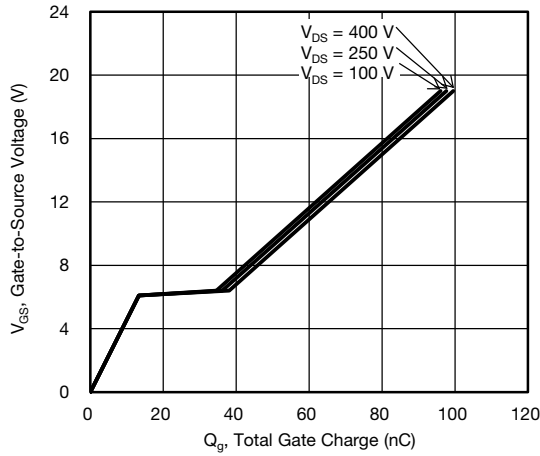


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

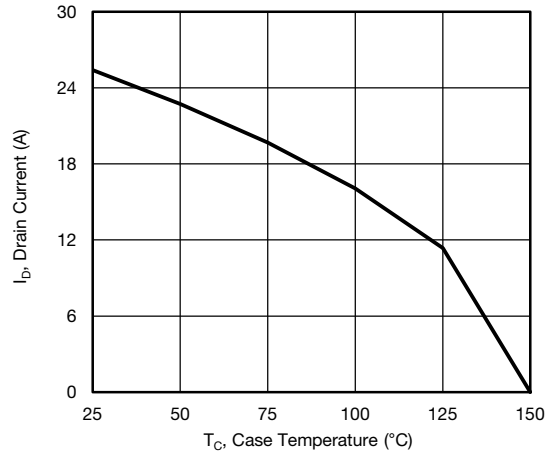


Fig. 10 - Maximum Drain Current vs. Case Temperature

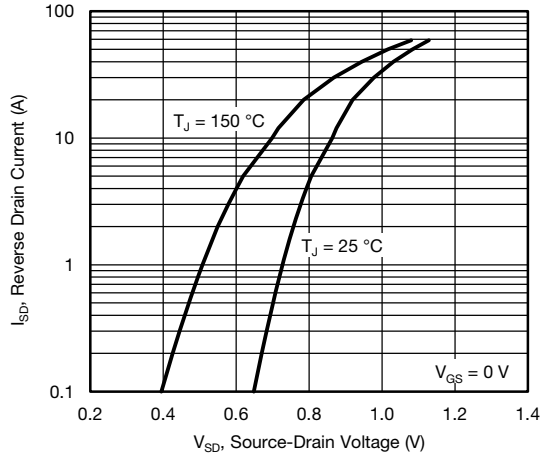


Fig. 8 - Typical Source-Drain Diode Forward Voltage

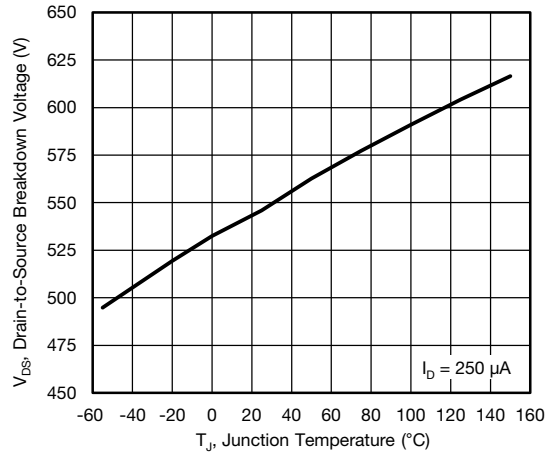


Fig. 11 - Typical Drain-to-Source Voltage vs. Temperature

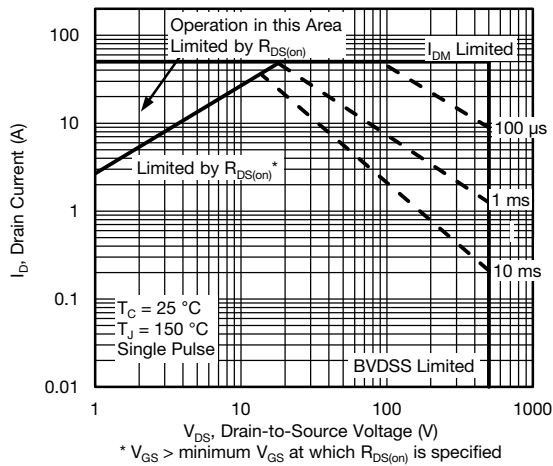


Fig. 9 - Maximum Safe Operating Area

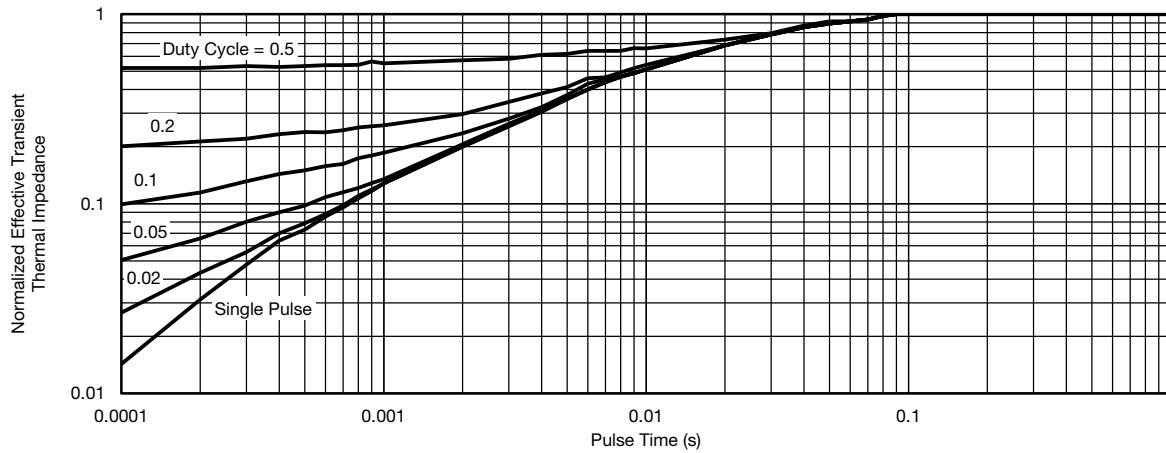


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

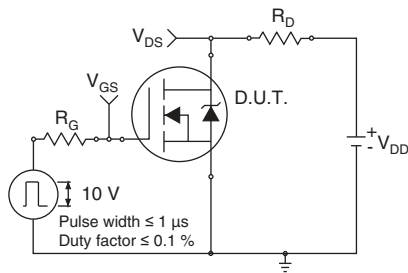


Fig. 13 - Switching Time Test Circuit

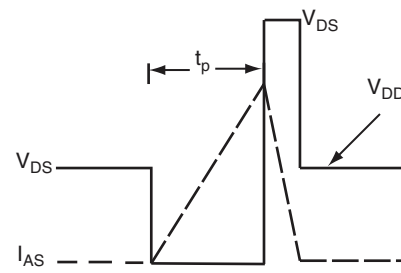


Fig. 16 - Unclamped Inductive Waveforms

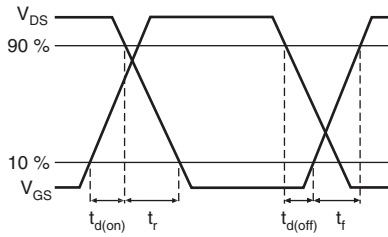


Fig. 14 - Switching Time Waveforms

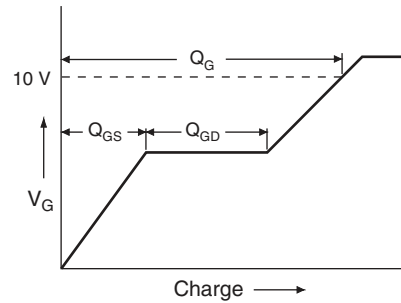


Fig. 17 - Basic Gate Charge Waveform

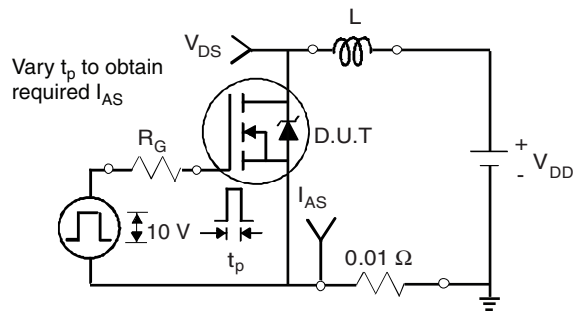


Fig. 15 - Unclamped Inductive Test Circuit

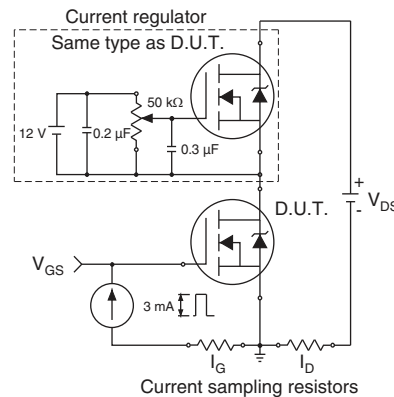
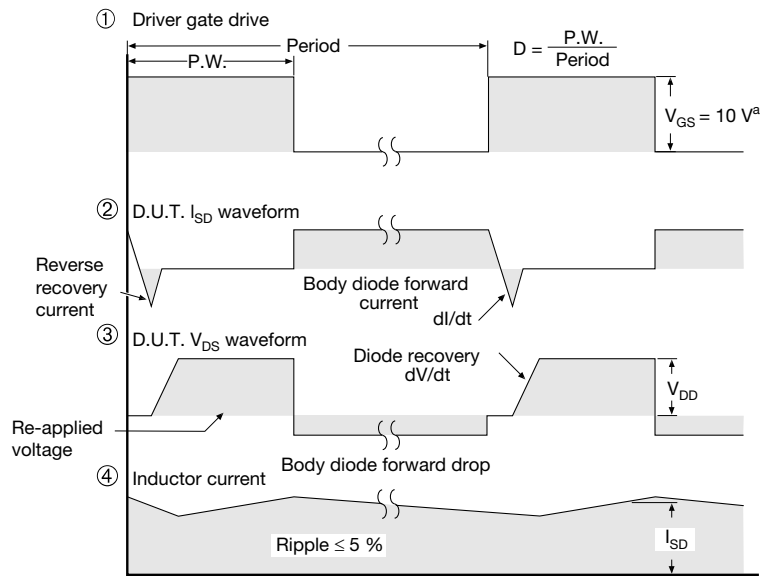
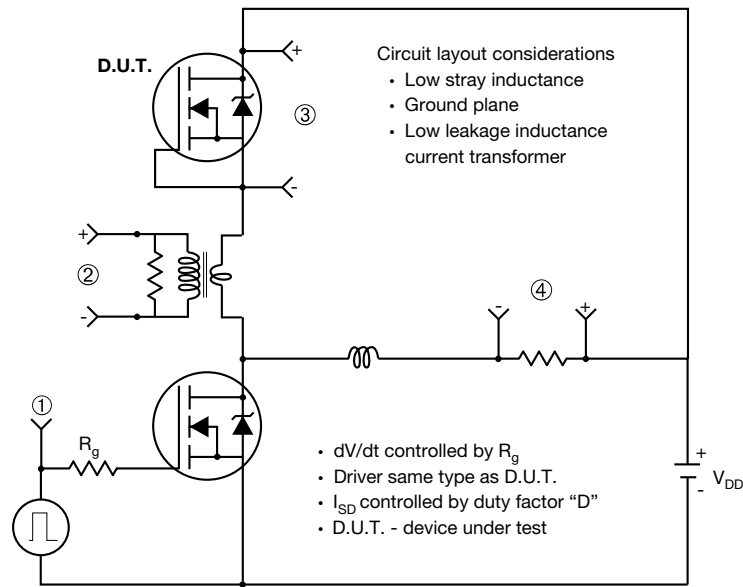


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

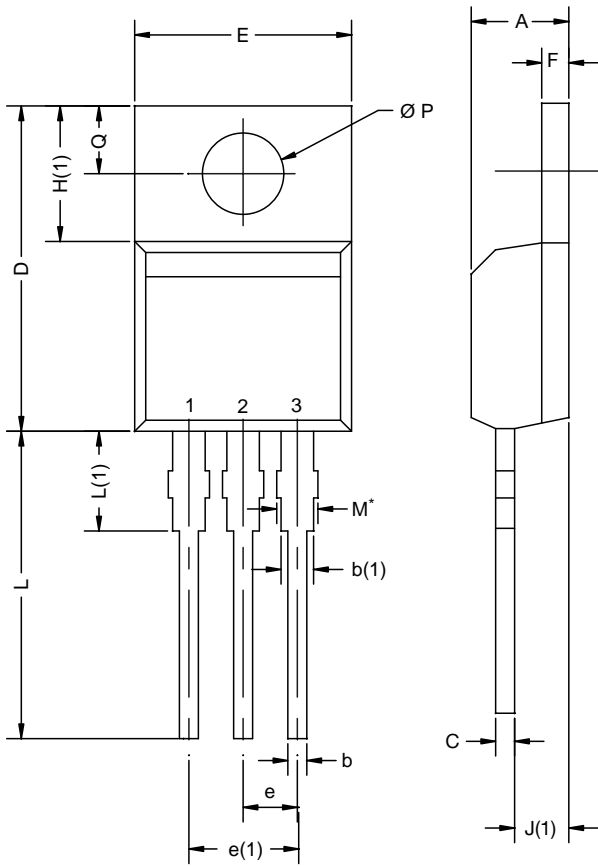


Note

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

Fig. 19 - For N-Channel

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DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12
DWG: 5471

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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