N-Channel 500V (D-S) Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.660
Q_g (Max.) (nC)	75	
Q_{gs} (nC)	18	
Q_{gd} (nC)	34	
Configuration	Single	

FEATURES

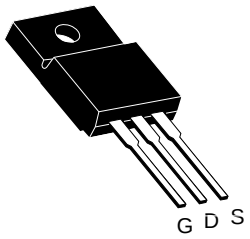
- Lower Gate Charge Q_g Results in Simpler Drive Reqirements
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage
- Compliant to RoHS Directive 2002/95/EC

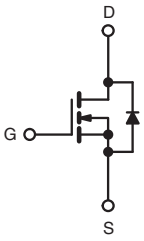
RoHS
Available

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supplies
- High Speed Power Switching

TO-220 FULLPAK





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	V_{GS} at 10 V	T_C = 25 °C	I_D	13	A
		T_C = 100 °C		8.1	
Pulsed Drain Current[a]			I_{DM}	50	
Linear Derating Factor				2.0	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	560	mJ
Avalanche Current[a]			I_{AR}	13	A
Repetitive Avalanche Energy[a]			E_{AR}	25	mJ
Maximum Power Dissipation	T_C = 25 °C		P_D	240	W
Peak Diode Recovery dV/dt[c]			dV/dt	9.2	V/ns
Operating Junction and Storage Temperature Range			T_J, T_{stg}	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s			300[d]	
Mounting Torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Starting T_J = 25 °C, L = 5.7 mH, R_g = 25 Ω, I_{AS} =14 A, dV/dt = 7.6 V/ns (see fig. 12a).
c. $I_{SD} \leq$ 14 A, dI/dt ≤ 250 A/µs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 150 °C.
d. 1.6 mm from case.

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Case-to-Sink, Flat, Greasd Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.50	

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	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA		-	0.55	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 30 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 500 V, V_{GS} = 0 V		-	-	25	µA
		V_{DS} = 400 V, V_{GS} = 0 V, T_J = 125 °C		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 8.4 A[b]	-	0.66	-	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 8.4 A		8.1	-	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	1510	-	pF
Output Capacitance	C_{oss}			-	280	-	
Reverse Transfer Capacitance	C_{rss}			-	11	-	
Output Capacitance	C_{oss}	V_{GS} = 0 V	V_{DS} = 1.0 V, f = 1.0 MHz	-	2730	-	
			V_{DS} = 400 V, f = 1.0 MHz	-	82	-	
Effective Output Capacitance	C_{oss} eff.		V_{DS} = 0 V to 400 V[c]	-	160	-	
Total Gate Charge	Q_g	V_{GS} = 10 V	I_D = 14 A, V_{DS} = 400 V, see fig. 6 and 13[b]	-	-	81	nC
Gate-Source Charge	Q_{gs}			-	-	20	
Gate-Drain Charge	Q_{gd}			-	-	36	
Turn-On Delay Time	$t_{d(on)}$		V_{DD} = 250 V, I_D = 14 A, R_g = 7.5 Ω, see fig. 10[b]	-	15	-	ns
Rise Time	t_r			-	39	-	
Turn-Off Delay Time	$t_{d(off)}$			-	39	-	
Fall Time	t_f			-	31	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	13	A
Pulsed Diode Forward Current[a]	I_{SM}			-	-	56	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = 14 A, V_{GS} = 0 V[b]		-	-	1.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = 14 A, T_J = 125 °C, dI/dt = 100 A/µs[b]		-	370	550	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	4.4	6.5	µC
Body Diode Reverse Recovery Current	I_{RRM}			-	21	31	A
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Pulse width ≤ 300 µs; duty cycle ≤ 2 %.
c. C_{oss} eff. is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

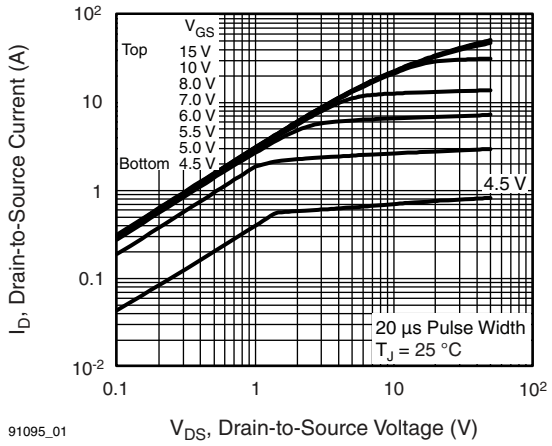


Fig. 1 - Typical Output Characteristics

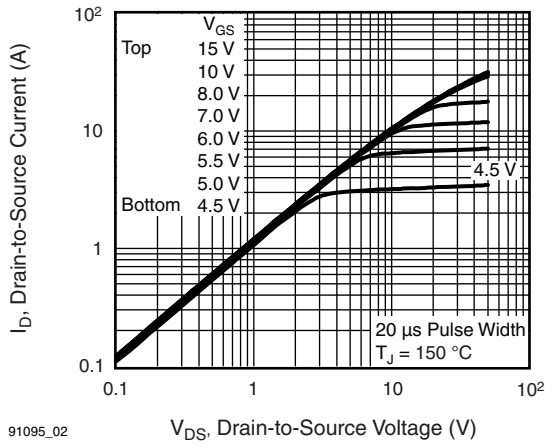


Fig. 2 - Typical Output Characteristics

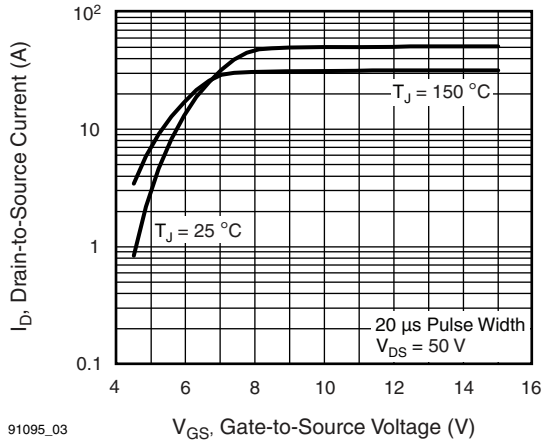


Fig. 3 - Typical Transfer Characteristics

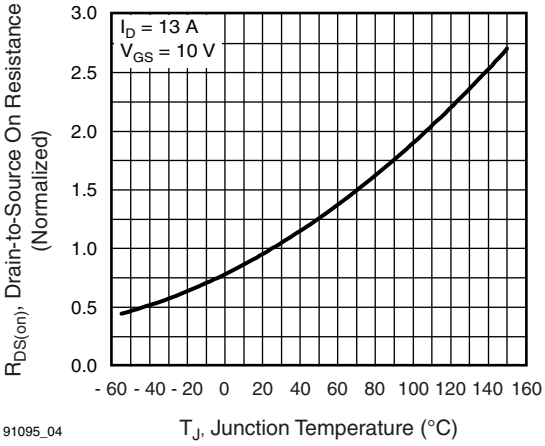


Fig. 4 - Normalized On-Resistance vs. Temperature

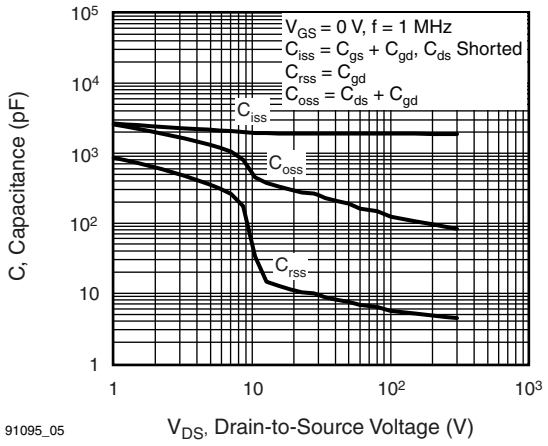


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

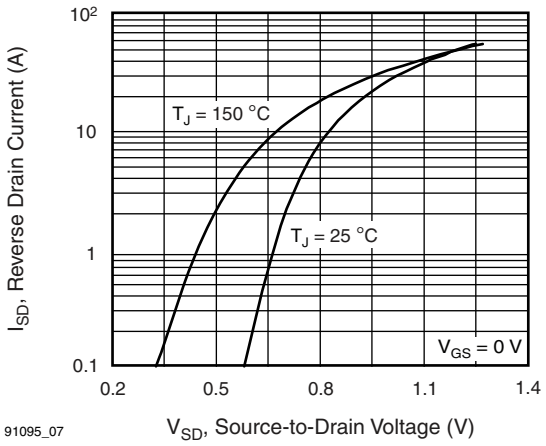


Fig. 7 - Typical Source-Drain Diode Forward Voltage

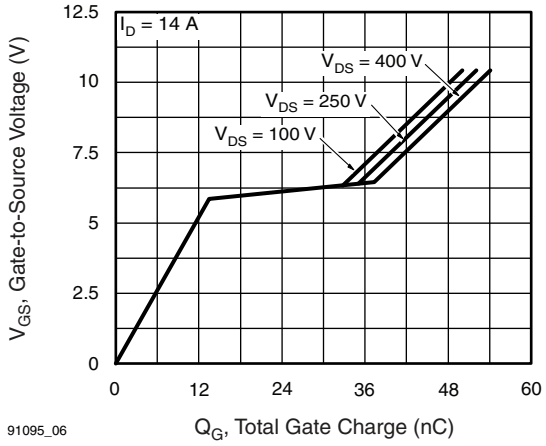


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

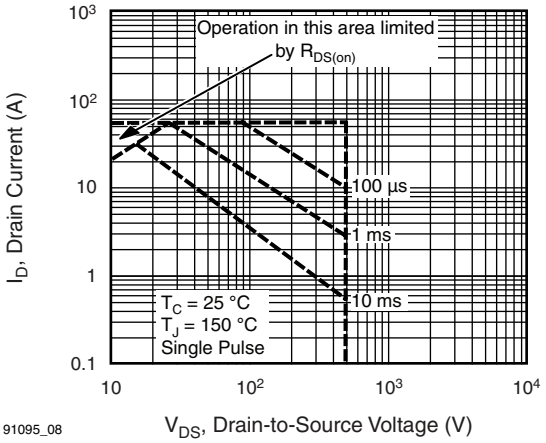


Fig. 8 - Maximum Safe Operating Area

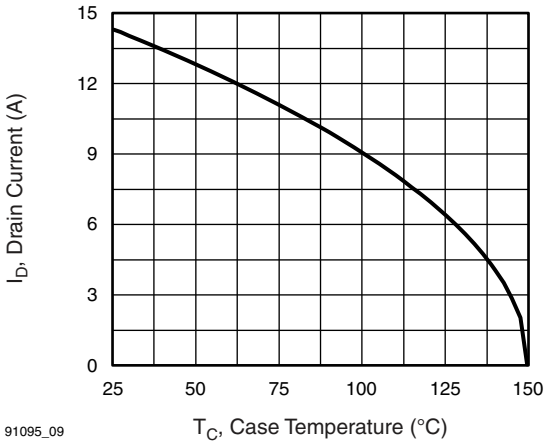


Fig. 9 - Maximum Drain Current vs. Case Temperature

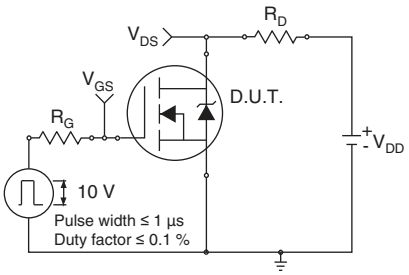


Fig. 10a - Switching Time Test Circuit

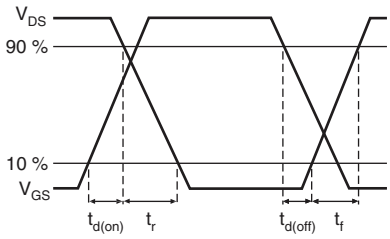


Fig. 10b - Switching Time Waveforms

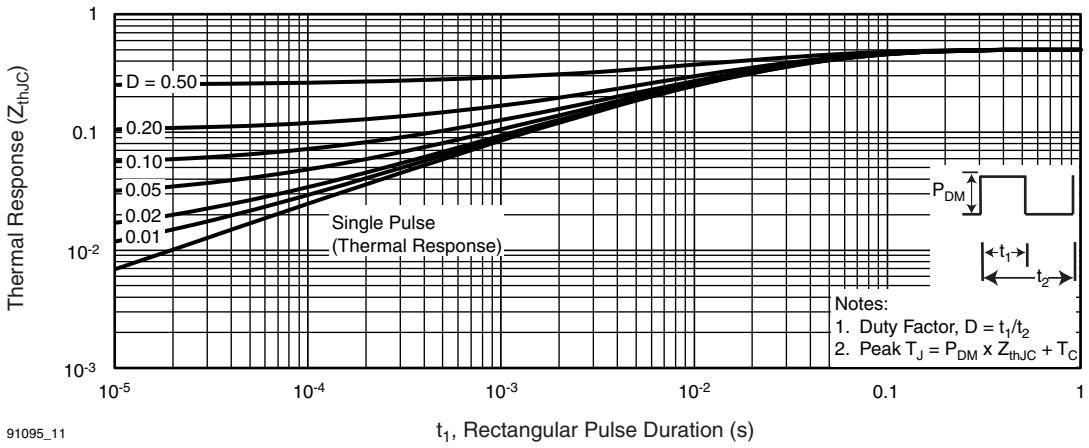


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

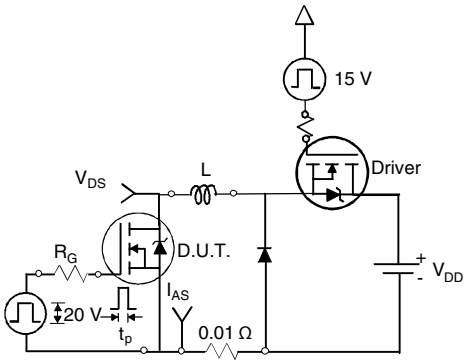


Fig. 12a - Unclamped Inductive Test Circuit

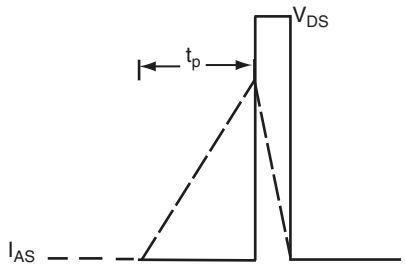


Fig. 12b - Unclamped Inductive Waveforms

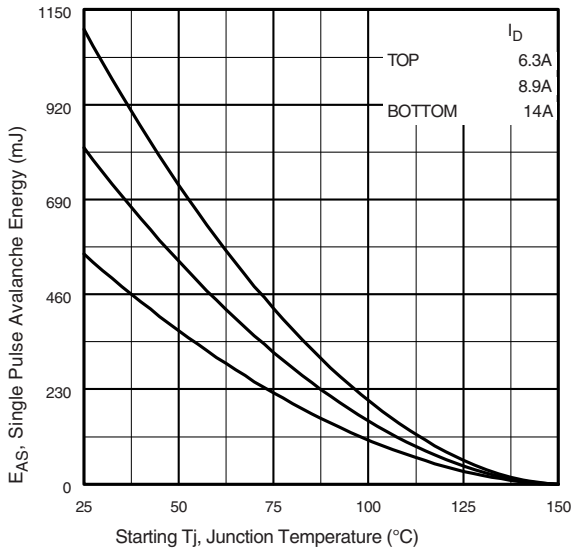


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

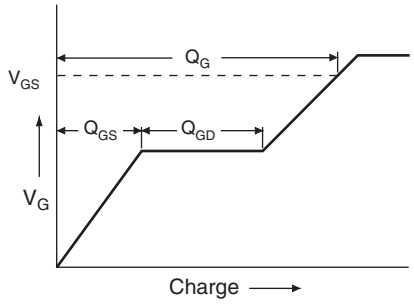


Fig. 13a - Basic Gate Charge Waveform

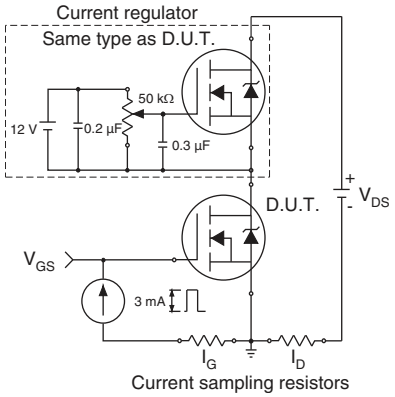
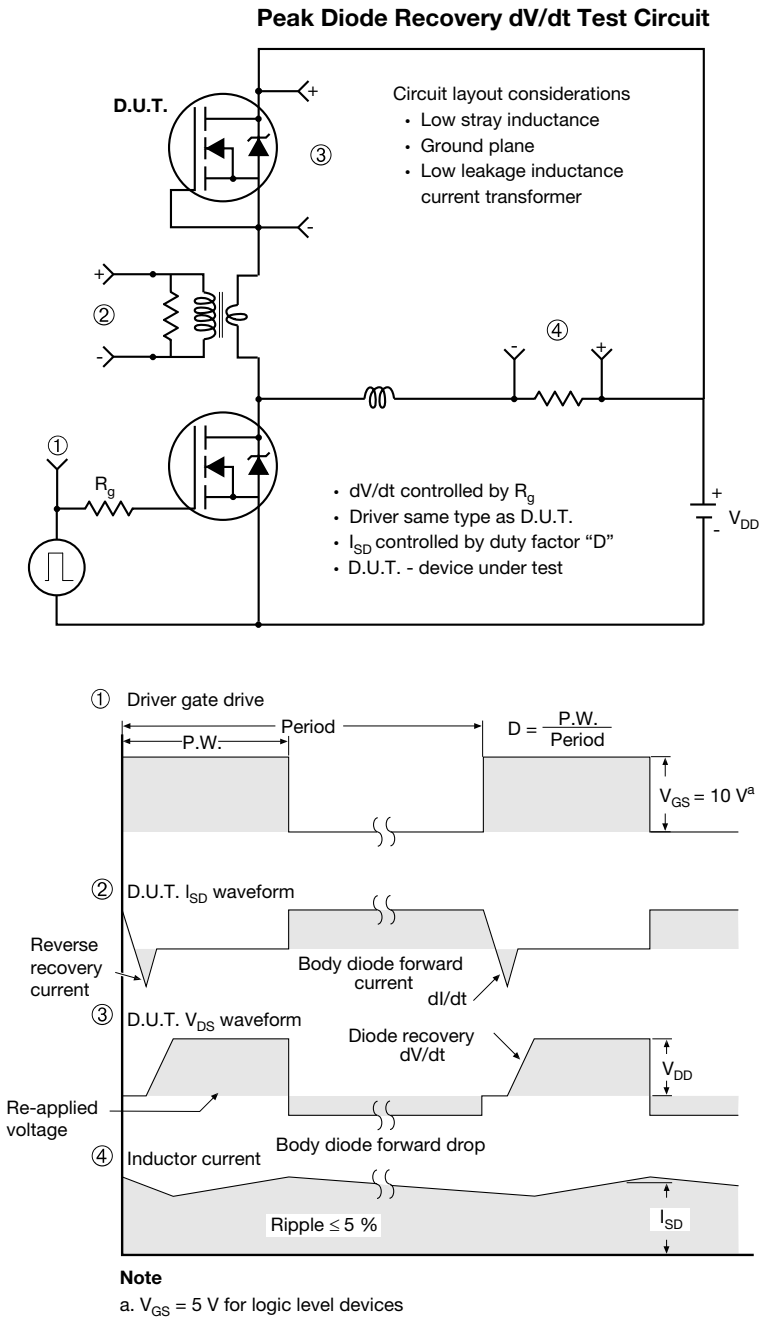


Fig. 13b - Gate Charge Test Circuit

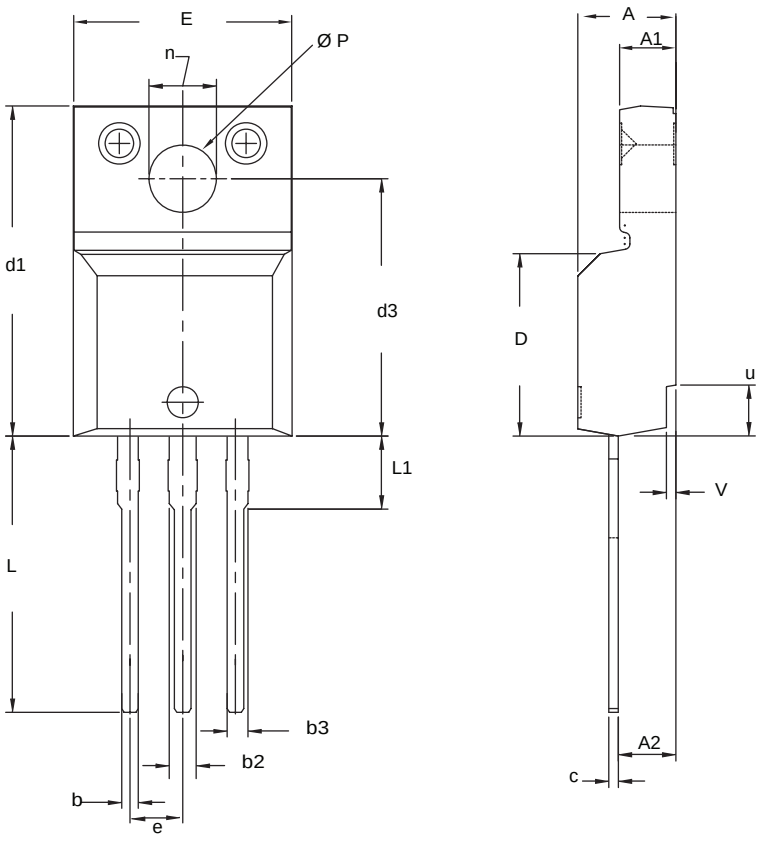


Note

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

Fig. 14 - For N-Channel

TO-220 FULLPAK (HIGH VOLTAGE)



	MILLIMETERS		INCHES	
DIM.	**MIN.**	**MAX.**	**MIN.**	**MAX.**
A	4.570	4.830	0.180	0.190
A1	2.570	2.830	0.101	0.111
A2	2.510	2.850	0.099	0.112
b	0.622	0.890	0.024	0.035
b2	1.229	1.400	0.048	0.055
b3	1.229	1.400	0.048	0.055
c	0.440	0.629	0.017	0.025
D	8.650	9.800	0.341	0.386
d1	15.88	16.120	0.622	0.635
d3	12.300	12.920	0.484	0.509
E	10.360	10.630	0.408	0.419
e	2.54 BSC		0.100 BSC	
L	13.200	13.730	0.520	0.541
L1	3.100	3.500	0.122	0.138
n	6.050	6.150	0.238	0.242
Ø P	3.050	3.450	0.120	0.136
u	2.400	2.500	0.094	0.098
v	0.400	0.500	0.016	0.020
ECN: X09-0126-Rev. B, 26-Oct-09 DWG: 5972				

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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