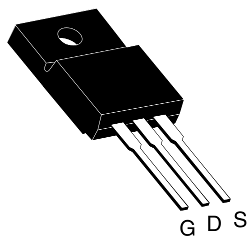
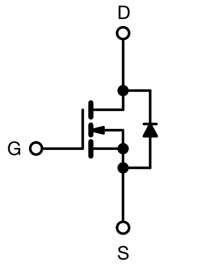
D Series Power MOSFET

TO-220 FULLPAK





N-Channel MOSFET

FEATURES

- Optimal design
  - Low area specific on-resistance
  - Low input capacitance (C_{iss})
  - Reduced capacitive switching losses
  - High body diode ruggedness
  - Avalanche energy rated (UIS)
- Optimal efficiency and operation
  - Low cost
  - Simple gate drive circuitry
  - Low figure-of-merit (FOM): R_{on} x Q_g
  - Fast switching
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS* Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	550	
$R_{DS(on)}$ max. (Ω) at 25 °C	V_{GS} = 10 V	0.28
Q_g max. (nC)	76	
Q_{gs} (nC)	11	
Q_{gd} (nC)	17	
Configuration	Single	

APPLICATIONS

- Consumer electronics
  - Displays (LCD or Plasma TV)
- Server and telecom power supplies
  - SMPS
- Industrial
  - Welding
  - Induction heating
  - Motor drives
- Battery chargers

ORDERING INFORMATION

Package	TO-220 FULLPAK
Lead (Pb)-free	SiHF18N50D-E3

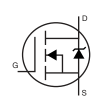
ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	500	V
Gate-source voltage			V_{GS}	± 30	
Gate-source voltage AC (f > 1 Hz)				30	
Continuous drain current (T_J = 150 °C) [e]	V_{GS} at 10 V	T_C = 25 °C	I_D	18	A
		T_C = 100 °C		11	
Pulsed drain current [a]			I_{DM}	53	
Linear derating factor				0.3	W/°C
Single pulse avalanche energy [b]			E_{AS}	115	mJ
Maximum power dissipation			P_D	39	W
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	°C
Drain-source voltage slope	T_J = 125 °C		dV/dt	24	V/ns
Reverse diode dV/dt [d]				0.4	
Soldering recommendations (peak temperature) [c]	For 10 s			300	°C
Mounting torque	M3 screw			0.6	Nm

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature
b. V_{DD} = 50 V, starting T_J = 25 °C, L = 2.3 mH, R_g = 25 Ω, I_{AS} = 10 A
c. 1.6 mm from case
d. $I_{SD} \leq I_D$, starting T_J = 25 °C
e. Limited by maximum junction temperature

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	R_{thJA}	-	65	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	3.2	

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 = 250 μA	-	0.58	-	V/°C
Gate threshold voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	3.0	-	5.0	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	-	-	1	μA
		V_{DS} = 400 V, V_{GS} = 0 V, T_J = 125 °C	-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 9 A	-	0.23	0.28	Ω
Forward transconductance	g_{fs}	V_{DS} = 50 V, I_D = 9 A	-	6.4	-	S
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 100 V, f = 1.0 MHz	-	1500	-	pF
Output capacitance	C_{oss}		-	131	-	
Reverse transfer capacitance	C_{rss}		-	14	-	
Effective output capacitance, energy related [a]	$C_{o(er)}$	V_{GS} = 0 V, V_{DS} = 0 V to 400 V	-	113	-	
Effective output capacitance, time related [b]	$C_{o(tr)}$		-	164	-	
Total gate charge	Q_g	V_{GS} = 10 V, I_D = 9 A, V_{DS} = 400 V	-	38	76	nC
Gate-source charge	Q_{gs}		-	11	-	
Gate-drain charge	Q_{gd}		-	17	-	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 400 V, I_D = 9 A, V_{GS} = 10 V, R_g = 9.1 Ω	-	19	38	ns
Rise time	t_r		-	36	72	
Turn-off delay time	$t_{d(off)}$		-	36	72	
Fall time	t_f		-	30	60	
Gate input resistance	R_g	f = 1 MHz, open drain	-	1.7	-	Ω
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse P - N junction diode 	-	-	18	A
Pulsed diode forward current	I_{SM}		-	-	72	
Diode forward voltage	V_{SD}	T_J = 25 °C, I_S = 9 A, V_{GS} = 0 V	-	-	1.2	V
Reverse recovery time	t_{rr}	T_J = 25 °C, I_F = I_S = 9 A, dI/dt = 100 A/μs, V_R = 20 V	-	354	-	ns
Reverse recovery charge	Q_{rr}		-	3.9	-	μC
Reverse recovery current	I_{RRM}		-	21	-	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)

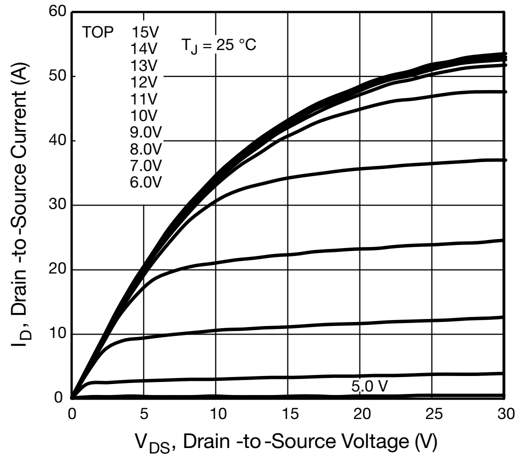


Fig. 1 - Typical Output Characteristics

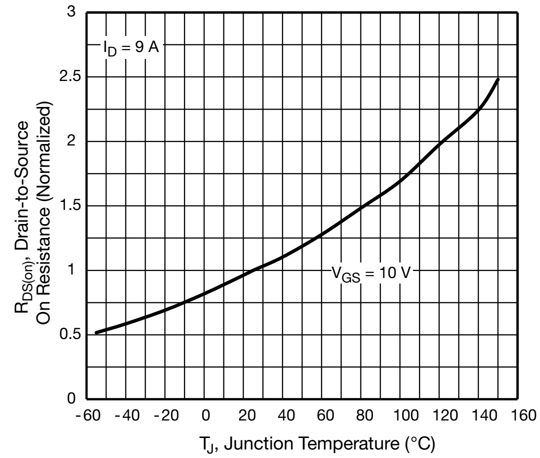


Fig. 4 - Normalized On-Resistance vs. Temperature

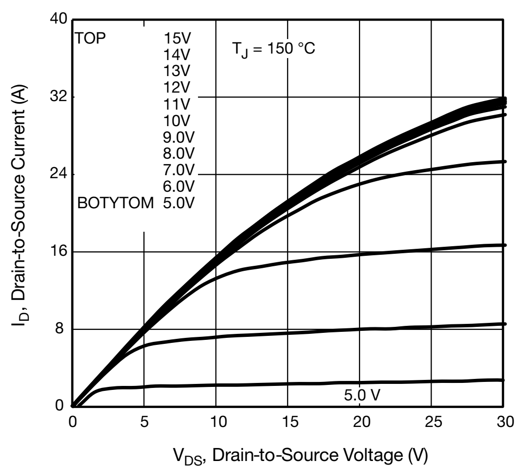


Fig. 2 - Typical Output Characteristics

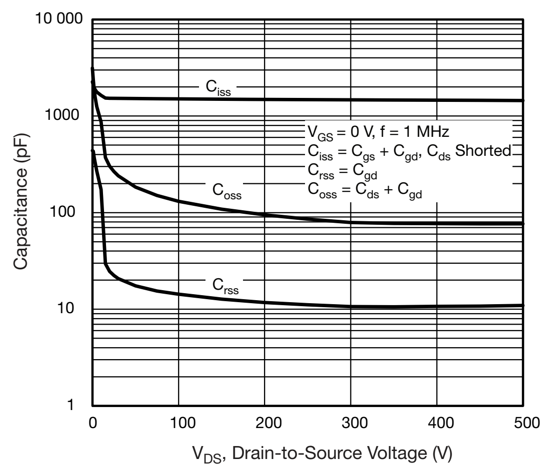


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

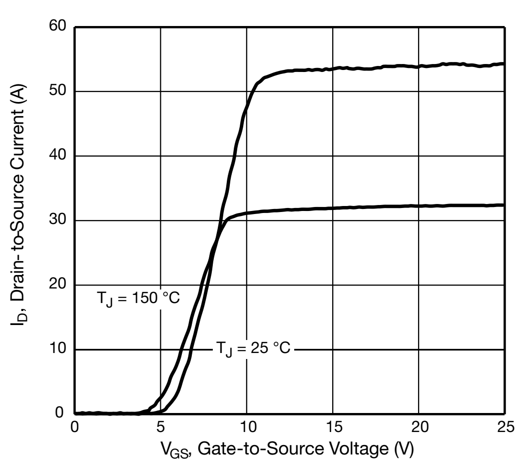


Fig. 3 - Typical Transfer Characteristics

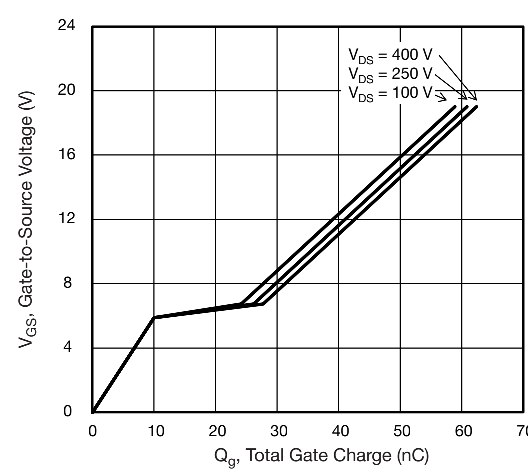


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

For technical questions, contact: hvm@vishay.com

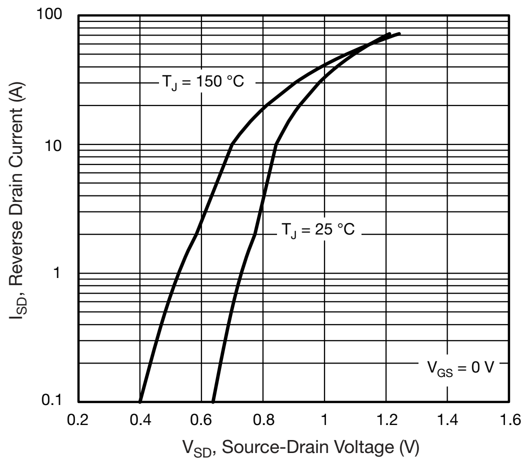


Fig. 7 - Typical Source-Drain Diode Forward Voltage

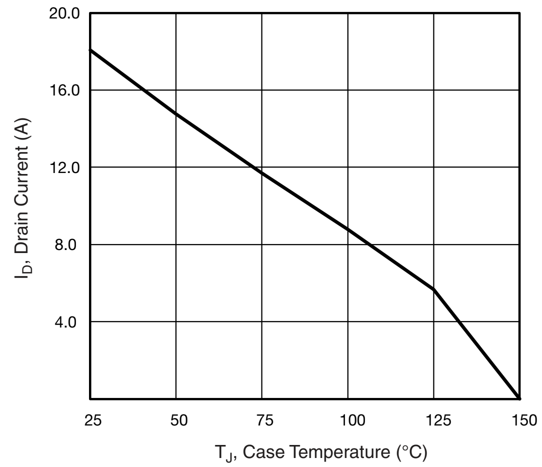


Fig. 9 - Maximum Drain Current vs. Case Temperature

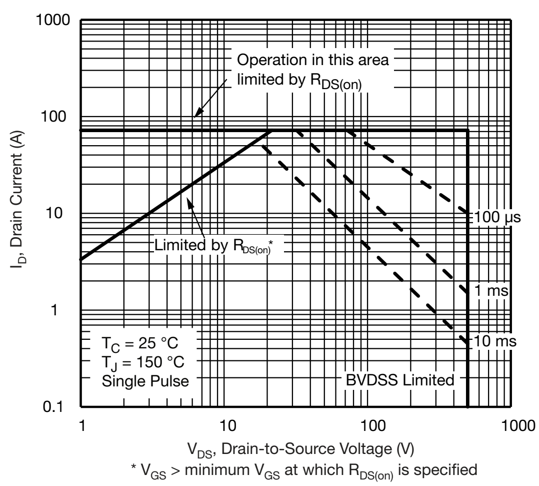


Fig. 8 - Maximum Safe Operating Area

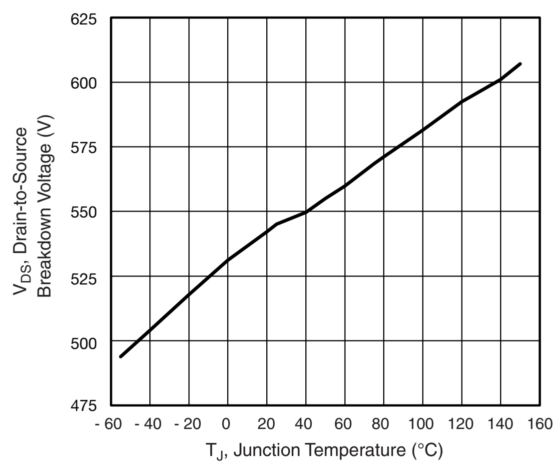


Fig. 10 - Typical Drain-to-Source Voltage vs. Temperature

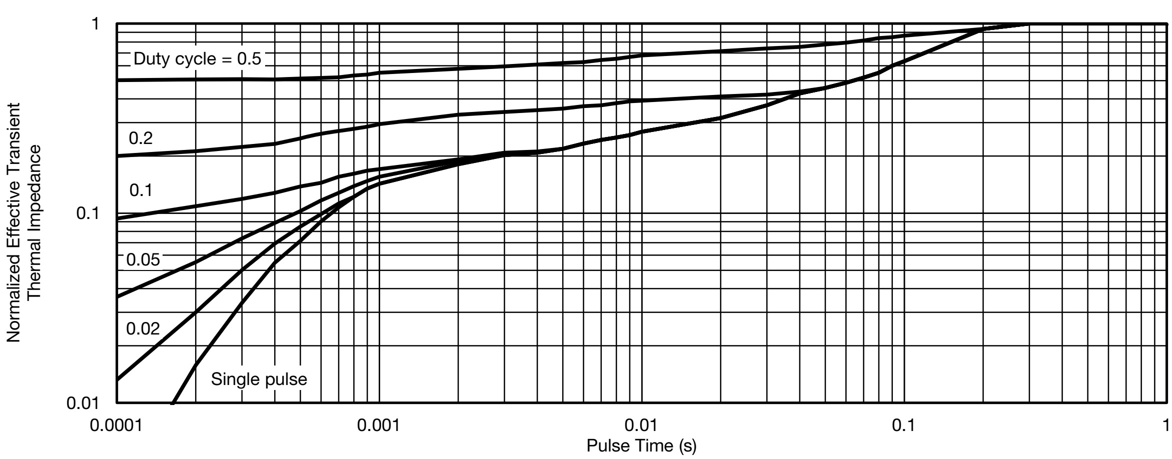


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case

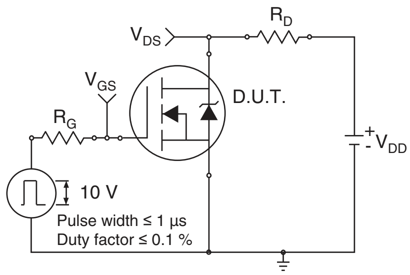


Fig. 12 - Switching Time Test Circuit

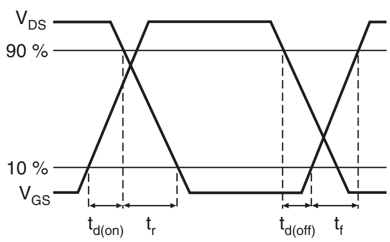


Fig. 13 - Switching Time Waveforms

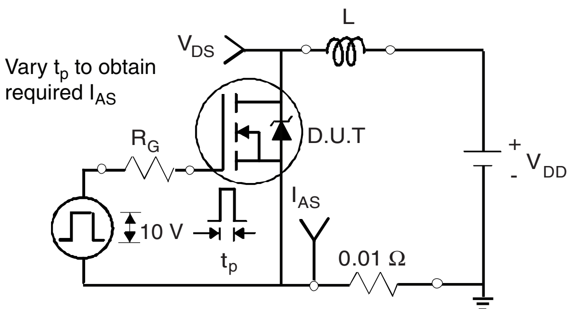


Fig. 14 - Unclamped Inductive Test Circuit

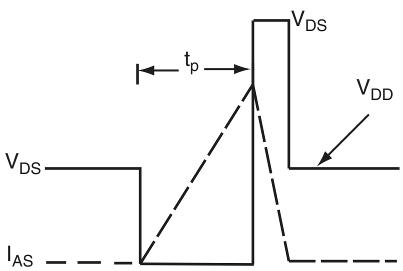


Fig. 15 - Unclamped Inductive Waveforms

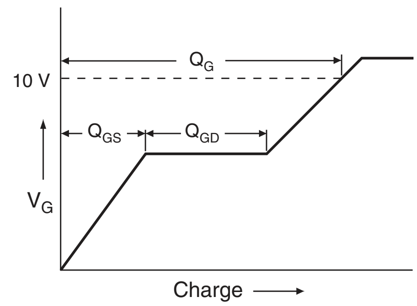


Fig. 16 - Basic Gate Charge Waveform

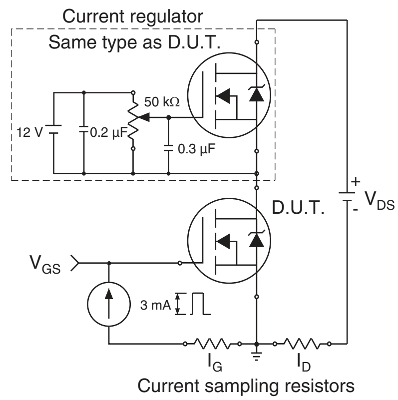
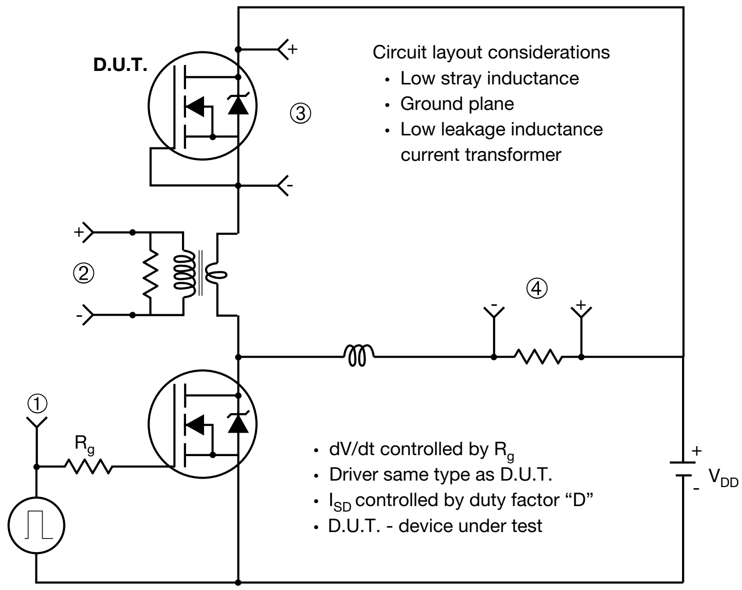
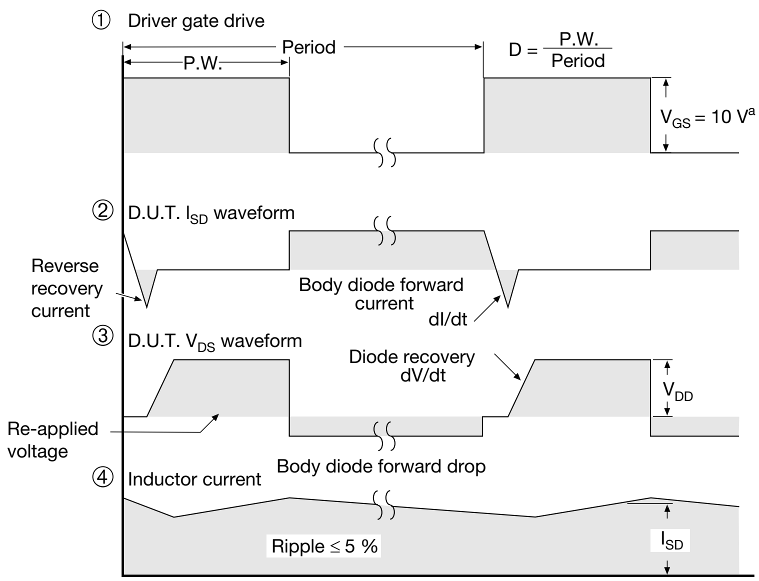


Fig. 17 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



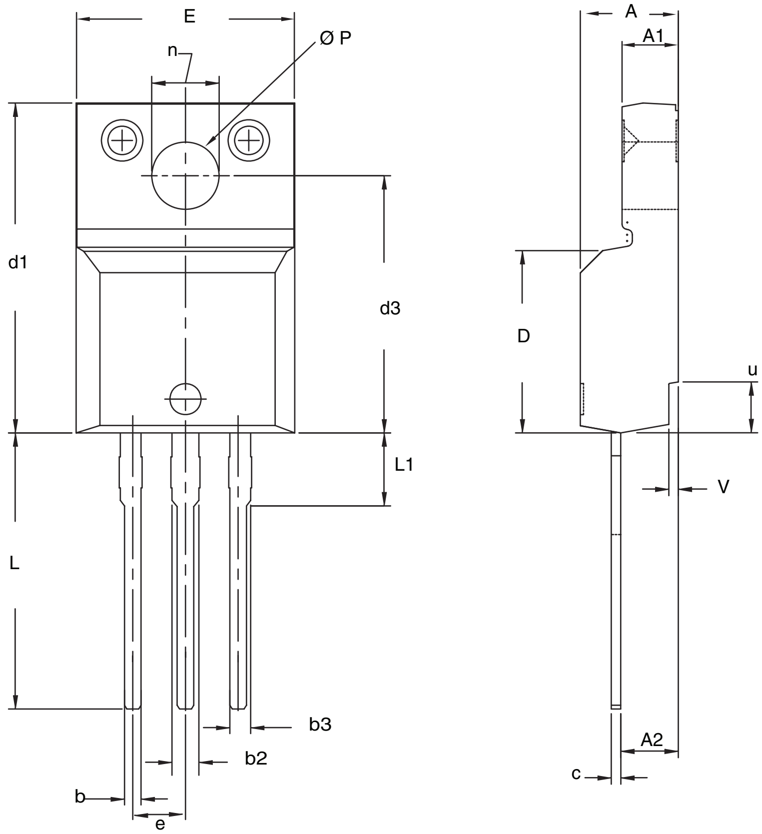


Note

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

Fig. 18 - 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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