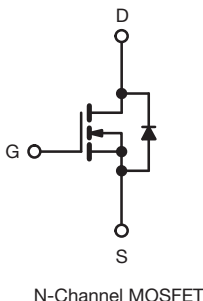


## E Series Power MOSFET

Thin-Lead TO-220 FULLPAK



### FEATURES

- Low figure-of-merit (FOM):  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### APPLICATIONS

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

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	550	
$R_{DS(on)}$ max. ( $\Omega$ ) at 25 °C	$V_{GS} = 10$ V	0.145
$Q_g$ max. (nC)	86	
$Q_{gs}$ (nC)	14	
$Q_{gd}$ (nC)	25	
Configuration	Single	

### ORDERING INFORMATION

Package	Thin-Lead TO-220 FULLPAK
Lead (Pb)-free	SiHA25N50E-E3
Lead (Pb)-free and halogen-free	SiHA25N50E-GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	500	V
Gate-source voltage	$V_{GS}$	$\pm 30$	
Continuous drain current ( $T_J = 150$ °C) <sup>e</sup>	$V_{GS}$ at 10 V	$T_C = 25$ °C	A
		$T_C = 100$ °C	
Pulsed drain current <sup>a</sup>	$I_{DM}$	50	
Linear derating factor		0.2	W/°C
Single pulse avalanche energy <sup>b</sup>	$E_{AS}$	273	mJ
Maximum power dissipation	$P_D$	35	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 % $V_{DS}$	V/ns
Reverse diode $dV/dt$ <sup>d</sup>			
Soldering recommendations (peak temperature) <sup>c</sup>	for 10 s	300	°C
Mounting torque	M3 screw	0.6	Nm


#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 4.4$  A
- 1.6 mm from case
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C
- Limited by maximum junction temperature

### THERMAL RESISTANCE RATINGS

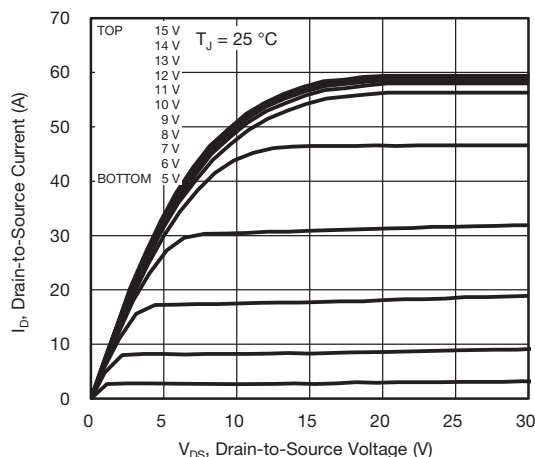
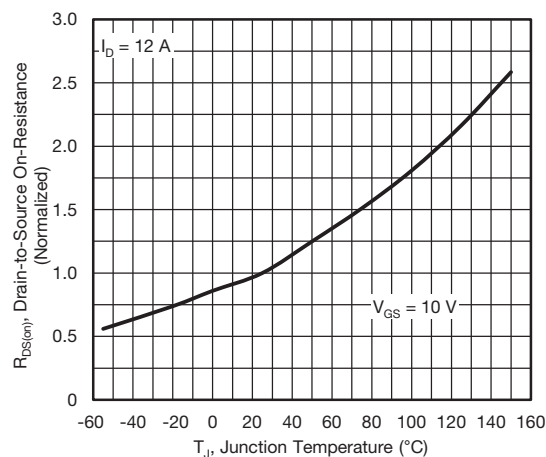
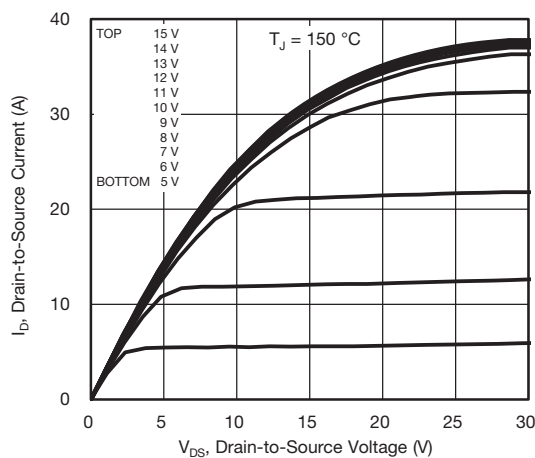
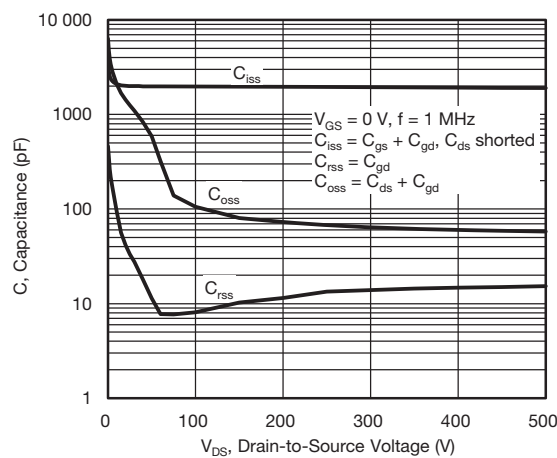
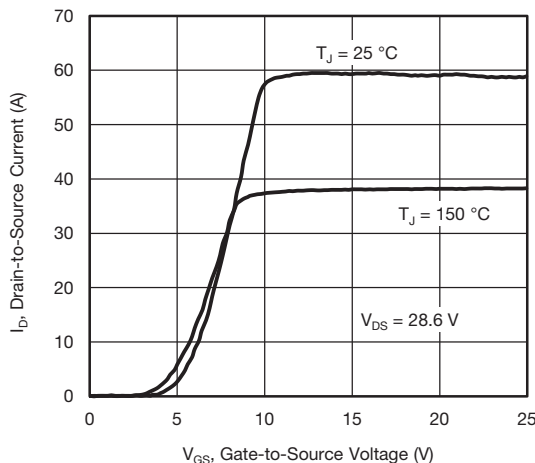
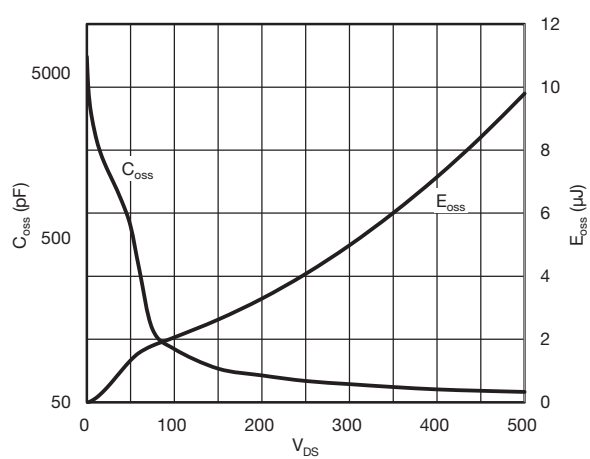
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	65	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	3.6	

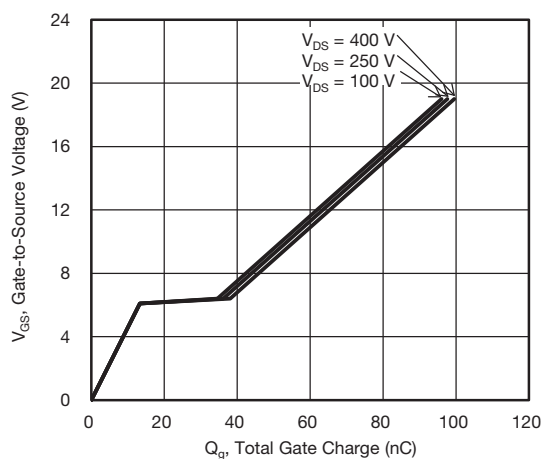
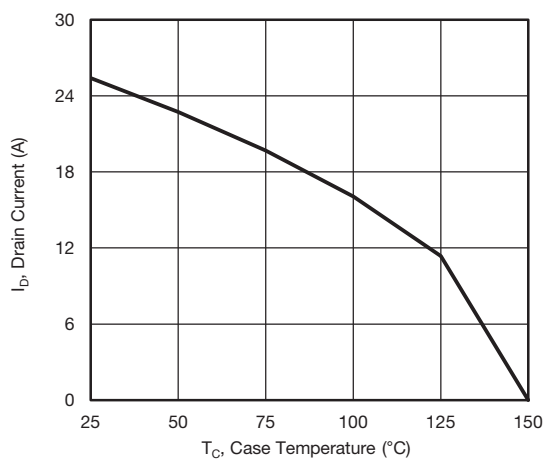
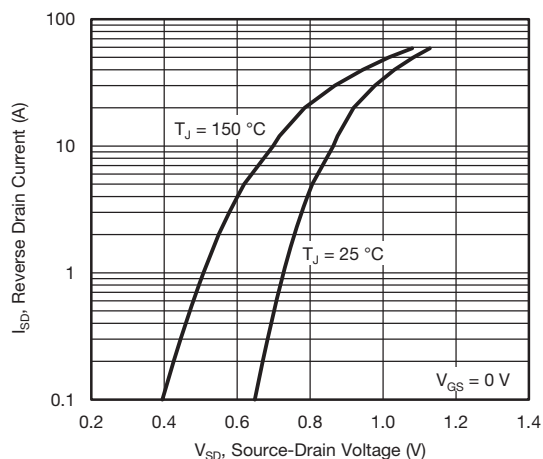
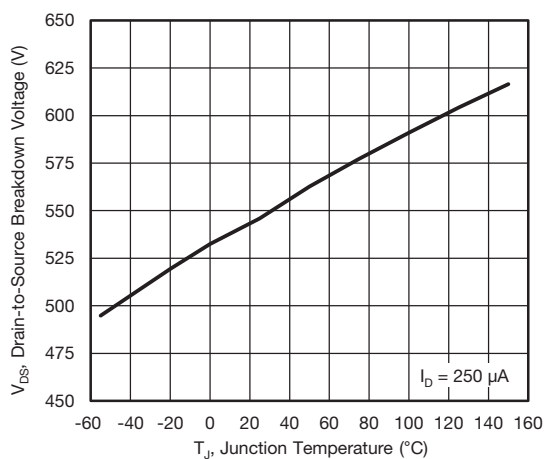
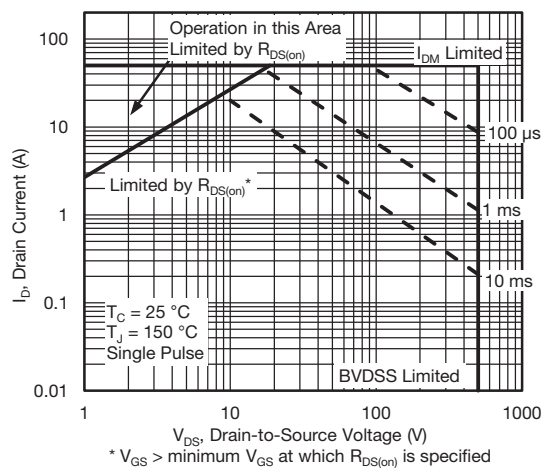


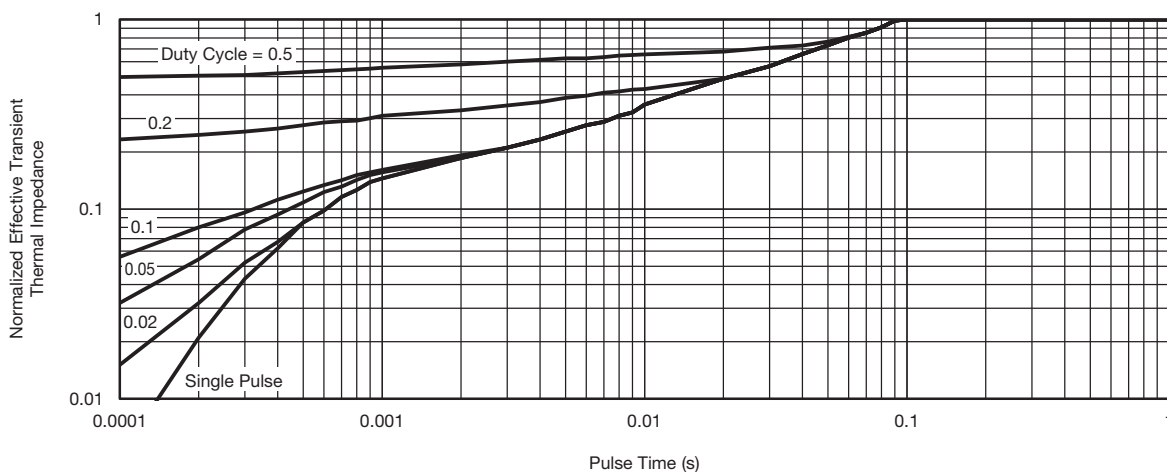
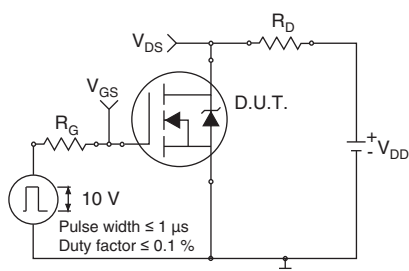
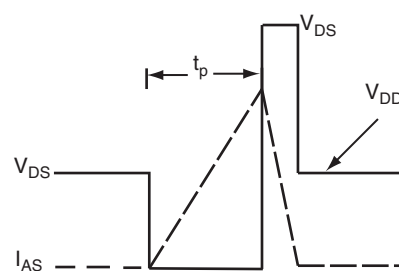
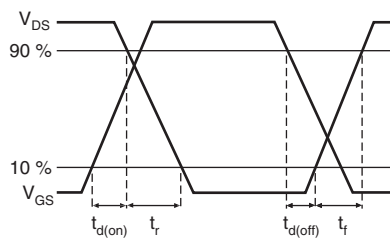
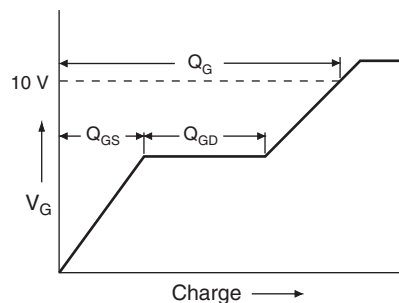
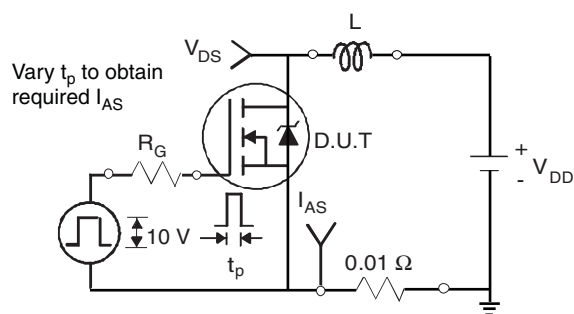
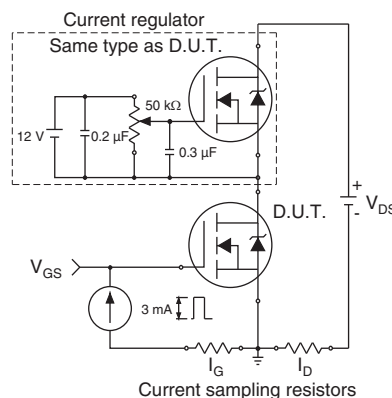
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		500	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA		-	0.59	-	V/°C
Gate-source threshold voltage (N)	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		2.0	-	4.0	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
		V <sub>GS</sub> = ± 30 V		-	-	± 1	μA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V		-	-	1	μA
		V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C		-	-	25	
Drain-source on-state resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 12 A	-	0.125	0.145	Ω
Forward transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 30 V, I <sub>D</sub> = 12 A		-	6.6	-	S
Dynamic							
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 100 V, f = 1 MHz		-	1980	-	pF
Output capacitance	C <sub>oss</sub>			-	105	-	
Reverse transfer capacitance	C <sub>rss</sub>			-	8	-	
Effective output capacitance, energy related <sup>a</sup>	C <sub>o(er)</sub>	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		-	105	-	pF
Effective output capacitance, time related <sup>b</sup>	C <sub>o(tr)</sub>			-	285	-	
Total gate charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 12 A, V <sub>DS</sub> = 400 V	-	57	86	nC
Gate-source charge	Q <sub>gs</sub>			-	14	-	
Gate-drain charge	Q <sub>gd</sub>			-	25	-	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 12 A R <sub>g</sub> = 9.1 Ω, V <sub>GS</sub> = 10 V		-	19	38	ns
Rise time	t <sub>r</sub>			-	36	72	
Turn-off delay time	t <sub>d(off)</sub>			-	57	86	
Fall time	t <sub>f</sub>			-	29	58	
Gate input resistance	R <sub>g</sub>	f = 1 MHz, open drain		-	0.56	-	Ω
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode		-	-	12	A
Pulsed diode forward current	I <sub>SM</sub>			-	-	50	
Diode forward voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 16.5 A, V <sub>GS</sub> = 0 V		-	-	1.2	V
Reverse recovery time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, I <sub>F</sub> = I <sub>S</sub> , dI/dt = 100 A/μs, V <sub>R</sub> = 25 V		-	338	-	ns
Reverse recovery charge	Q <sub>rr</sub>			-	5.3	-	μC
Reverse recovery current	I <sub>RRM</sub>			-	29	-	A

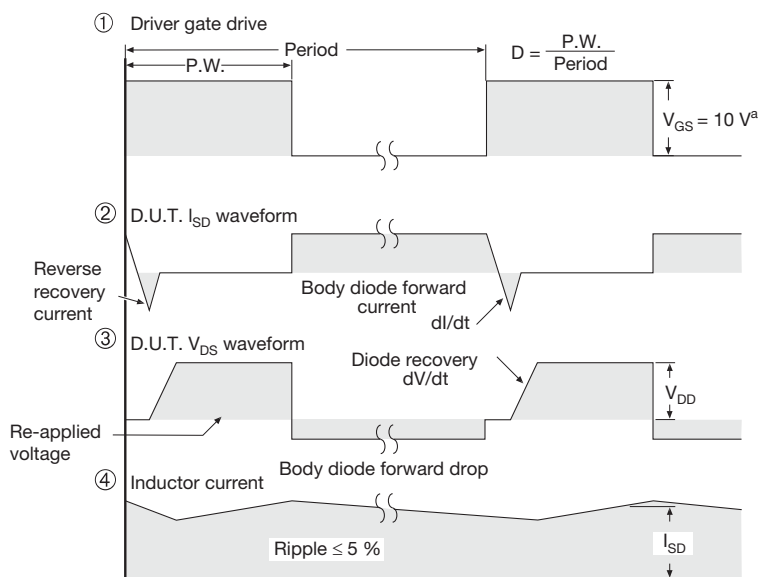
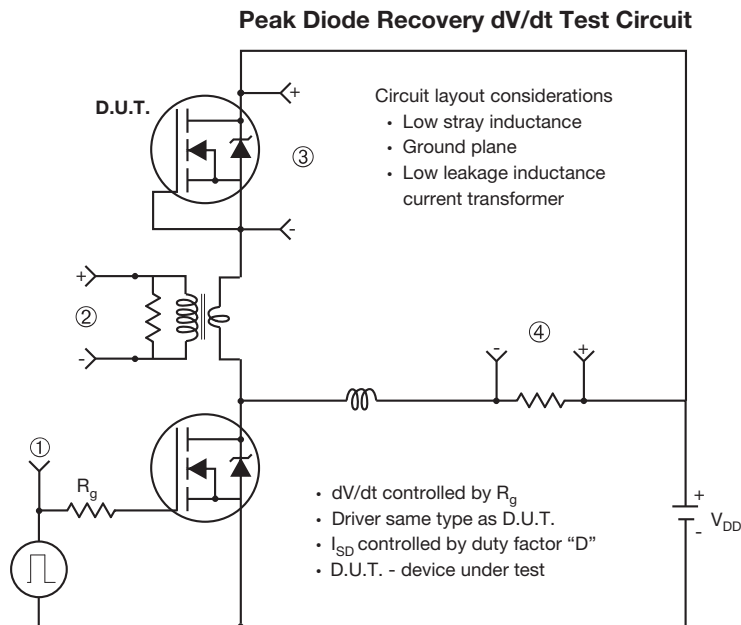
**Notes**

- a. C<sub>oss(er)</sub> is a fixed capacitance that gives the same energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 % to 80 % V<sub>DSS</sub>  
b. C<sub>oss(tr)</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 % to 80 % V<sub>DSS</sub>

**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 - 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**

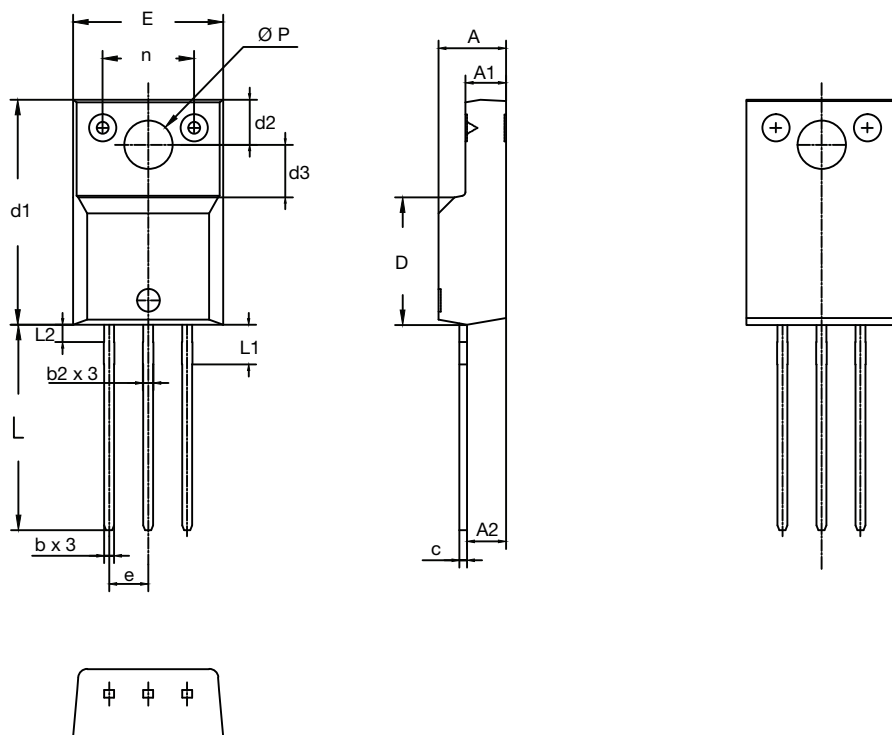

**Note**

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

**Fig. 19 - For N-Channel**

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## TO-220 FULLPAK Thin Lead



SYMBOL	DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.30	4.70	0.169	0.185
A1	2.50	2.90	0.098	0.114
A2	2.50	2.70	0.098	0.106
b	0.60	0.80	0.024	0.031
b2	0.60	0.90	0.024	0.035
c	-	0.60	-	0.024
D	8.30	8.70	0.327	0.342
d1	14.70	15.30	0.579	0.602
d2	2.90	3.10	0.114	0.122
d3	3.40	3.60	0.134	0.142
E	9.70	10.30	0.382	0.406
e	2.50	2.70	0.098	0.106
L	13.40	13.80	0.528	0.543
L1	2.50	2.80	0.098	0.110
L2	-	1.20	-	0.047
n	6.05	6.15	0.238	0.242
Ø P	3.00	3.40	0.118	0.134
ECN: T16-0549-Rev. C, 12-Sep-16 DWG: 6021				



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