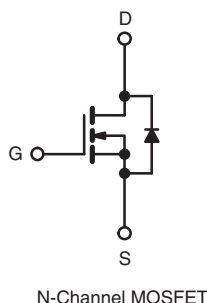
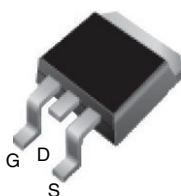


E Series Power MOSFET

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	650	
$R_{DS(on)}$ max. at 25 °C (Ω)	$V_{GS} = 10$ V	0.38
Q_g max. (nC)	58	
Q_{gs} (nC)	6	
Q_{gd} (nC)	13	
Configuration	Single	

D²PAK (TO-263)


FEATURES

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



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Industrial
 - Welding
 - Induction heating
 - Motor drives
 - Battery chargers
 - Renewable energy
 - Solar (PV inverters)

ORDERING INFORMATION

Package	D ² PAK (TO-263)
Lead (Pb)-free and Halogen-free	SiHB12N60E-GE3

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

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V _{DS}	600	V
Gate-Source Voltage			V _{GS}	± 30	
Continuous Drain Current (T _J = 150 °C)	V _{GS} at 10 V	T _C = 25 °C	I _D	12	A
		T _C = 100 °C		7.8	
Pulsed Drain Current ^a			I _{DM}	27	
Linear Derating Factor				1.2	W/°C
Single Pulse Avalanche Energy ^b			E _{AS}	117	mJ
Maximum Power Dissipation			P _D	147	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	70	V/ns
Reverse Diode dV/dt ^d				5	
Soldering Recommendations (Peak Temperature) ^c	for 10 s			300	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DS} = 50$ V, starting $T_J = 25$ °C, $L = 11.6$ mH, $R_g = 25$ Ω , $I_{AS} = 4.5$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.

**THERMAL RESISTANCE RATINGS**

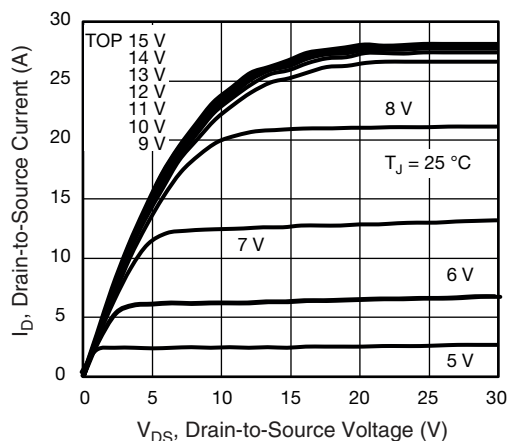
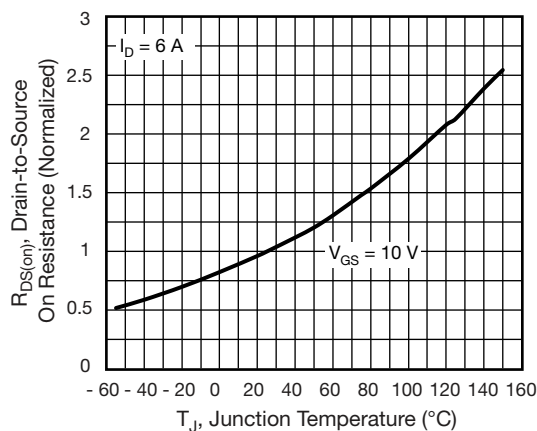
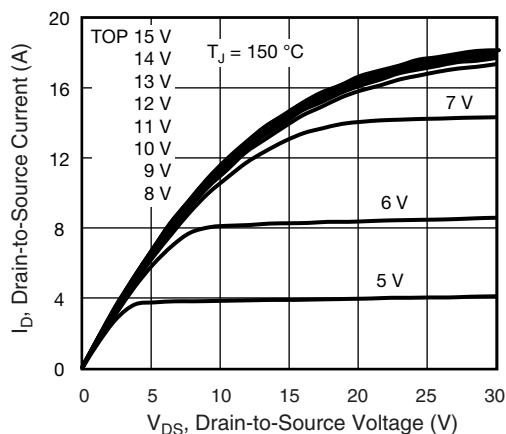
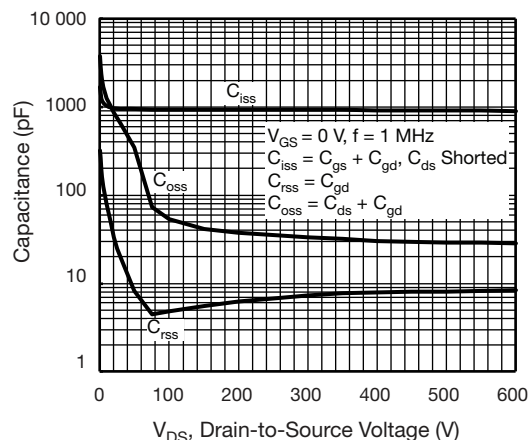
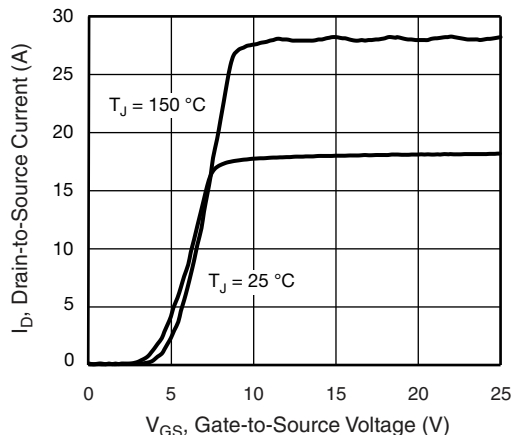
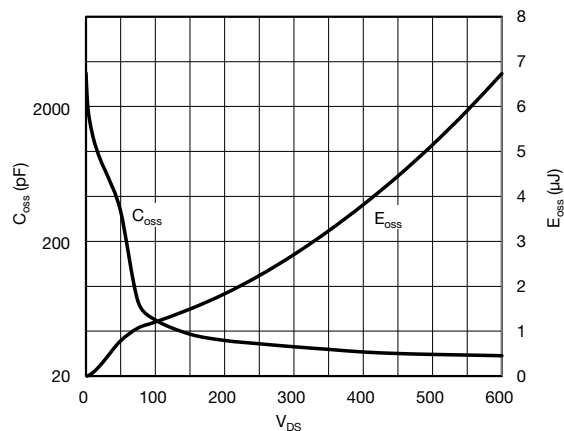
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.85	

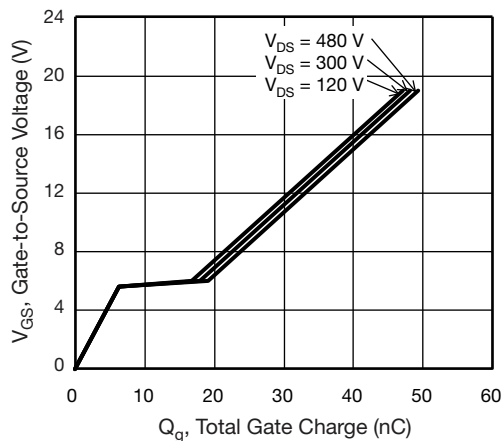
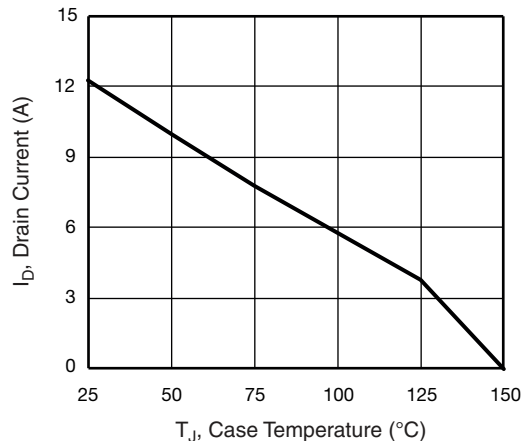
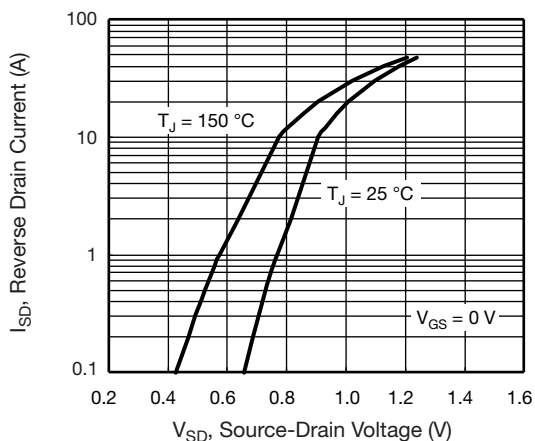
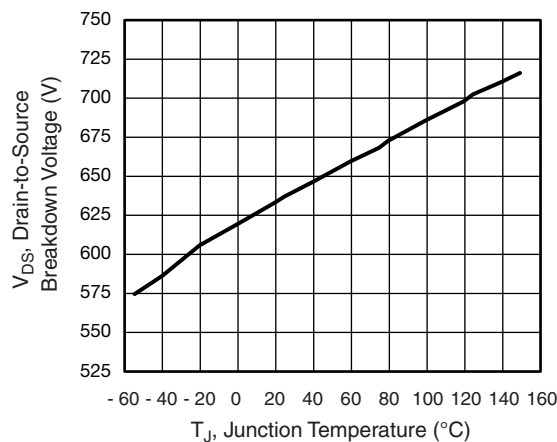
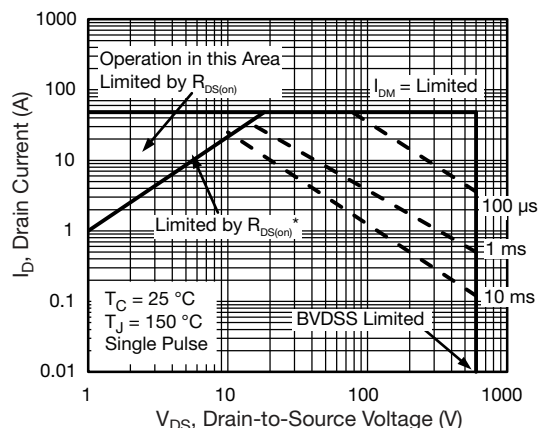
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		600	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.71	-	V/°C
Gate-Source Threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2	-	4	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} = 600 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C		-	-	10	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 6 A	-	0.32	0.38	Ω
Forward Transconductance	g _{fs}	V _{DS} = 40 V, I _D = 8 A		-	3.8	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	937	-	pF
Output Capacitance	C _{oss}			-	53	-	
Reverse Transfer Capacitance	C _{rss}			-	5	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}	V _{DS} = 0 V to 480 V, V _{GS} = 0 V		-	41	-	pF
Effective Output Capacitance, Time Related ^b	C _{o(tr)}			-	136	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 6 A, V _{DS} = 480 V	-	29	58	nC
Gate-Source Charge	Q _{gs}			-	6	-	
Gate-Drain Charge	Q _{gd}			-	13	-	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 480 V, I _D = 6 A, V _{GS} = 10 V, R _g = 9.1 Ω		-	14	28	ns
Rise Time	t _r			-	19	38	
Turn-Off Delay Time	t _{d(off)}			-	35	70	
Fall Time	t _f			-	19	38	
Gate Input Resistance	R _g	f = 1 MHz, open drain		-	1.1	-	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}			-	-	48	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 6 A, V _{GS} = 0 V		-	-	1.2	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S = 6 A, dI/dt = 100 A/μs, V _R = 25 V		-	350	-	ns
Reverse Recovery Charge	Q _{rr}			-	4	-	μC
Reverse Recovery Current	I _{RRM}			-	19	-	A

Notes

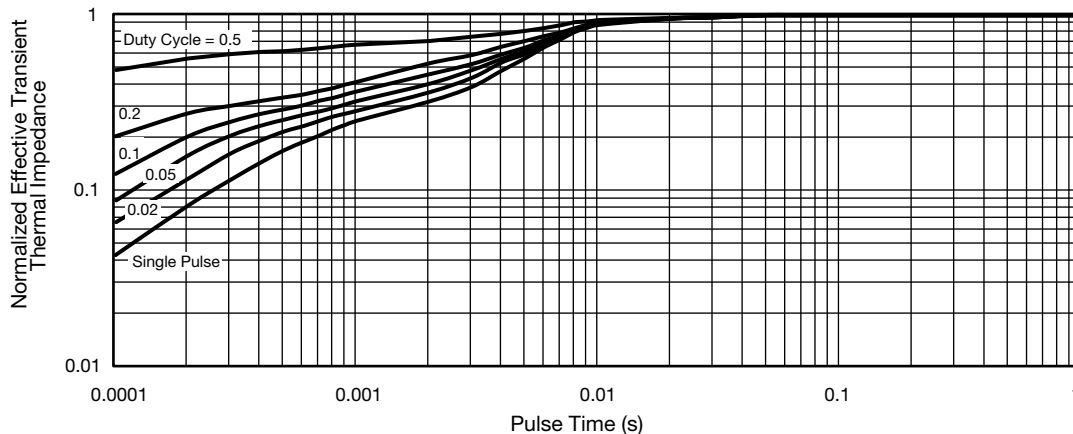
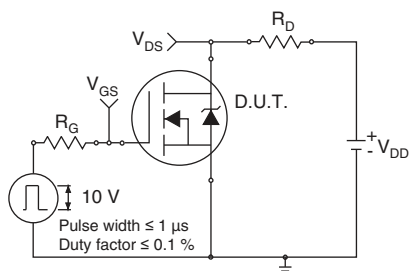
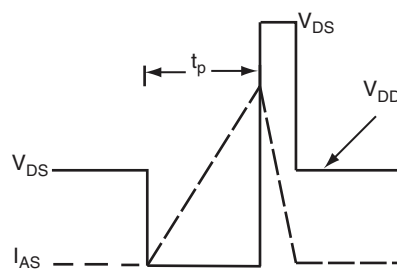
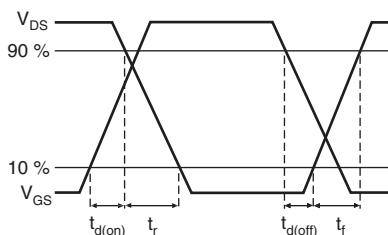
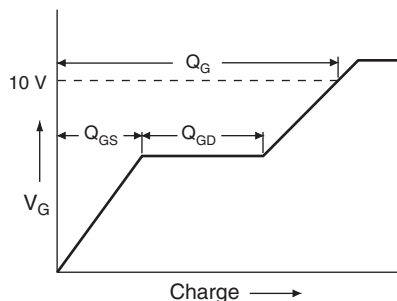
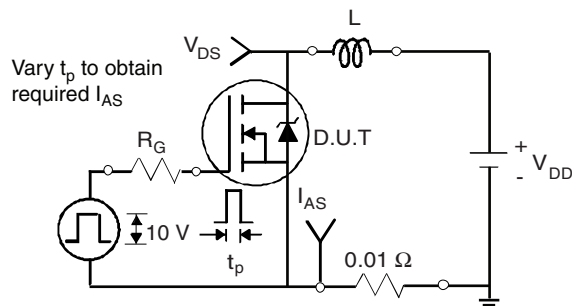
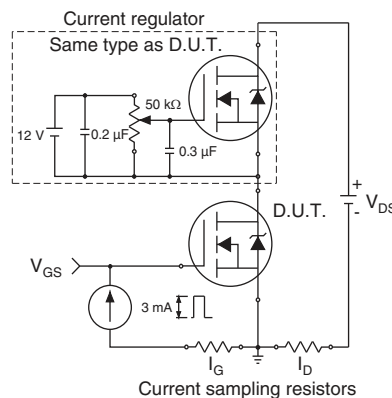
- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

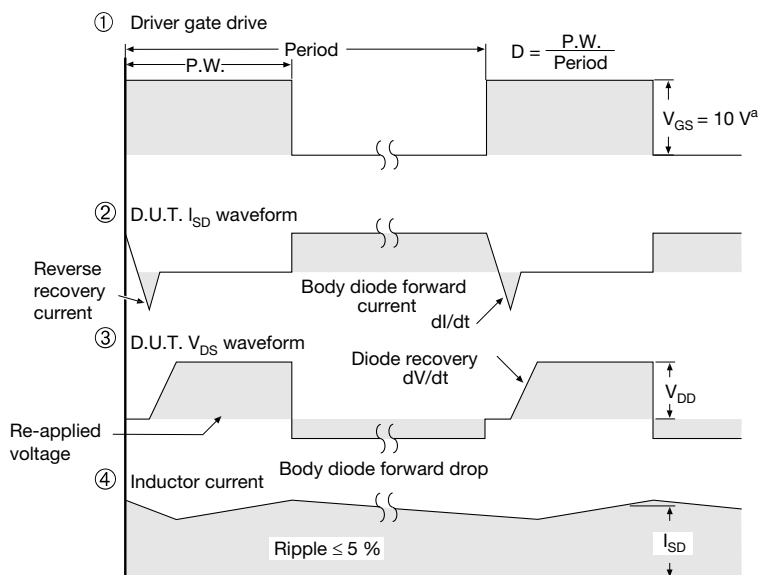
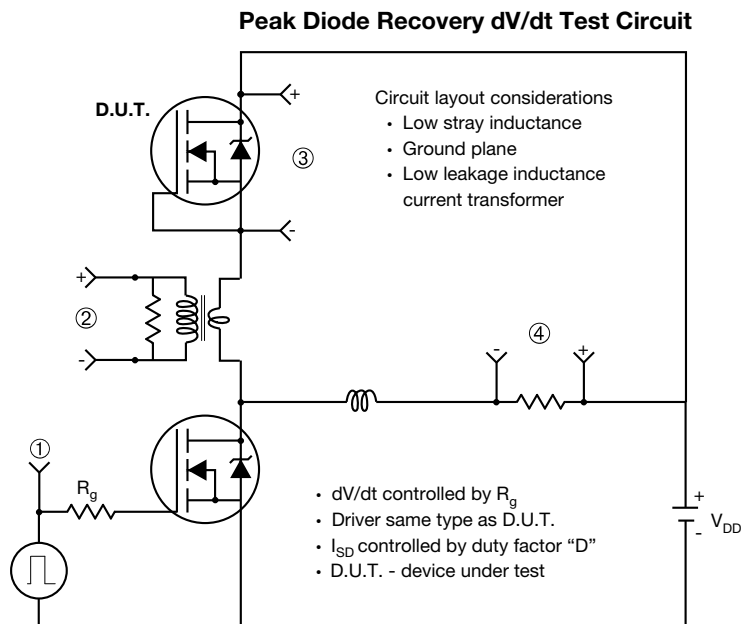
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

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


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

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

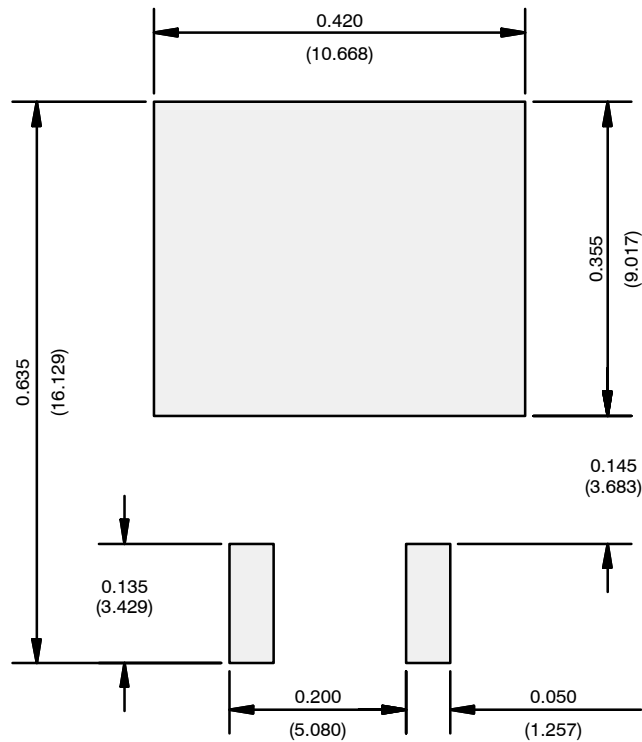
a. $V_{GS} = 5 V$ for logic level devices

Fig. 19 - For N-Channel

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	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)



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