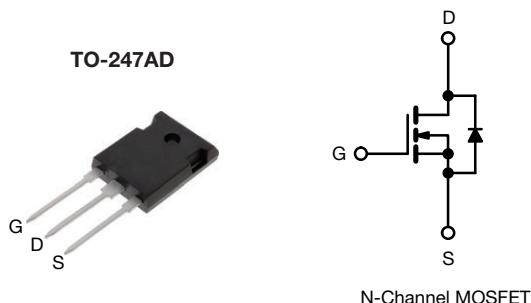


E Series Power MOSFET With Fast Body Diode



FEATURES

- Fast body diode MOSFET using E series technology
- Reduced t_{rr} , Q_{rr} , and I_{RRM}
- Low figure-of-merit (FOM): $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Low switching losses due to reduced Q_{rr}
- 175 °C operating temperature
- AEC-Q101 qualified
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



PRODUCT SUMMARY

V_{DS} (V) at T_J max.	700	
$R_{DS(on)}$ typ. (Ω) at 25 °C	$V_{GS} = 10$ V	0.095
Q_g typ. (nC)	115	
Q_{gs} (nC)	26	
Q_{gd} (nC)	44	
Configuration	Single	

APPLICATIONS

- Automotive onboard charger
- Automotive DC/DC converter

ORDERING INFORMATION

Package	TO-247AD
Lead (Pb)-free and halogen-free	SQW33N65EF-GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	650	V
Gate-source voltage	V_{GS}	± 30	
Continuous drain current ($T_J = 150$ °C)	V_{GS} at 10 V	$T_C = 25$ °C	A
		$T_C = 100$ °C	
Pulsed drain current ^a	I_{DM}	95	
Linear derating factor		2.5	W/°C
Single pulse avalanche energy ^b	E_{AS}	508	mJ
Maximum power dissipation	P_D	375	W
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +175	°C
Drain-source voltage slope	dV/dt	100	V/ns
Reverse diode dV/dt ^d		50	
Soldering recommendations (peak temperature) ^c	For 10 s	260	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 140$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 6.0$ A
- 1.6 mm from case
- $I_{SD} \leq I_D$, $dI/dt = 160$ A/ μ s, 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}	-	0.4	



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		650	-	-	V
V _{DS} temperature coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 10 mA		-	0.69	-	V/°C
Gate-source threshold voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	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} = 520 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 520 V, V _{GS} = 0 V, T _J = 125 °C		-	-	500	
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 16.5 A	-	0.095	0.109	Ω
Forward transconductance ^a	g _{fs}	V _{DS} = 30 V, I _D = 16.5 A		-	13	-	S
Dynamic							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	3972	-	pF
Output capacitance	C _{oss}			-	163	-	
Reverse transfer capacitance	C _{rss}			-	5	-	
Effective output capacitance, energy related ^a	C _{o(er)}	V _{GS} = 0 V, V _{DS} = 0 V to 520 V		-	117	-	pF
Effective output capacitance, time related ^b	C _{o(tr)}			-	482	-	
Total gate charge	Q _g	V _{GS} = 10 V	I _D = 16.5 A, V _{DS} = 520 V	-	115	173	nC
Gate-source charge	Q _{gs}			-	26	-	
Gate-drain charge	Q _{gd}			-	44	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 520 V, I _D = 16.5 A R _g = 9.1 Ω, V _{GS} = 10 V		-	32	64	ns
Rise time	t _r			-	51	77	
Turn-off delay time	t _{d(off)}			-	134	201	
Fall time	t _f			-	62	93	
Gate input resistance	R _g	f = 1 MHz, open drain		0.4	0.9	1.8	Ω
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	34	A
Pulsed diode forward current	I _{SM}			-	-	95	
Diode forward voltage	V _{SD}	T _J = 25 °C, I _S = 16.5 A, V _{GS} = 0 V		-	0.9	1.2	V
Reverse recovery time	t _{rr}	T _J = 25 °C, I _F = I _S = 16.5 A, dI/dt = 100 A/μs, V _R = 400 V		-	178	356	ns
Reverse recovery charge	Q _{rr}			-	1.4	2.8	μC
Reverse recovery current	I _{RRM}			-	17	-	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_{DS}
b. $C_{oss(tr)}$ is a fixed capacitance that gives the charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

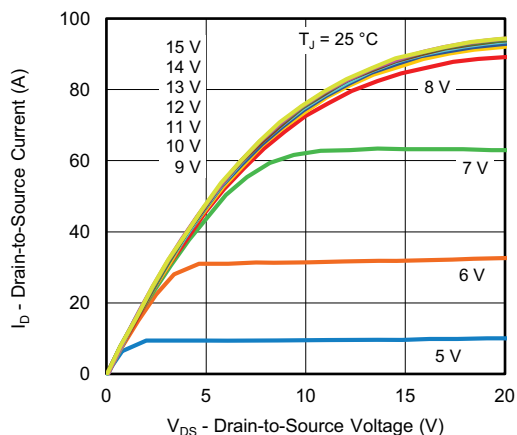


Fig. 1 - Typical Output Characteristics

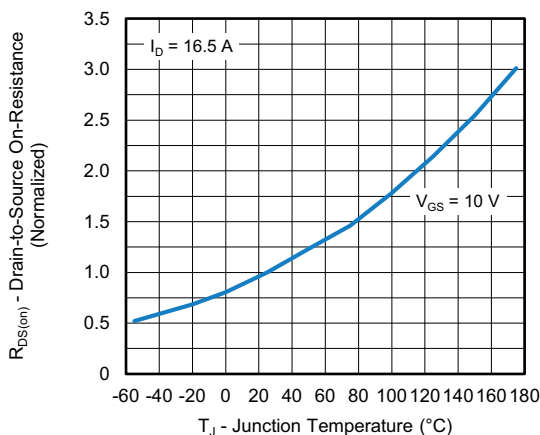


Fig. 4 - Normalized On-Resistance vs. Temperature

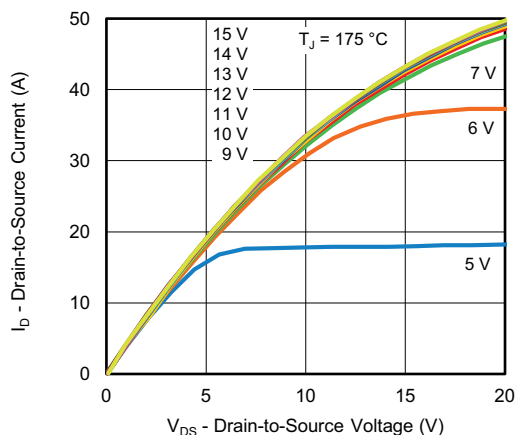


Fig. 2 - Typical Output Characteristics

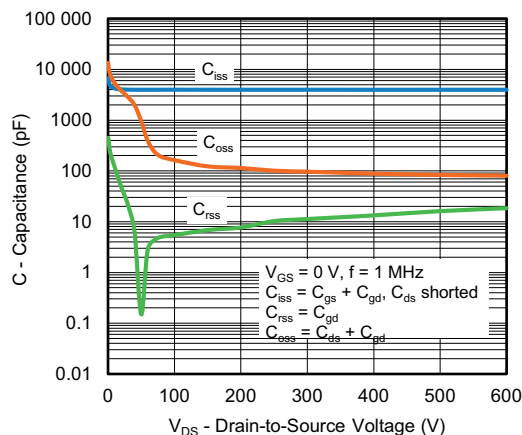


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

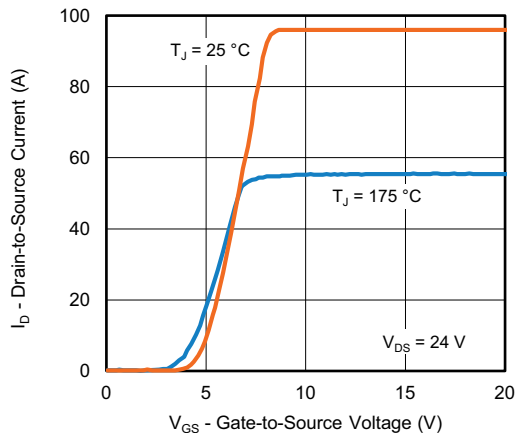


Fig. 3 - Typical Transfer Characteristics

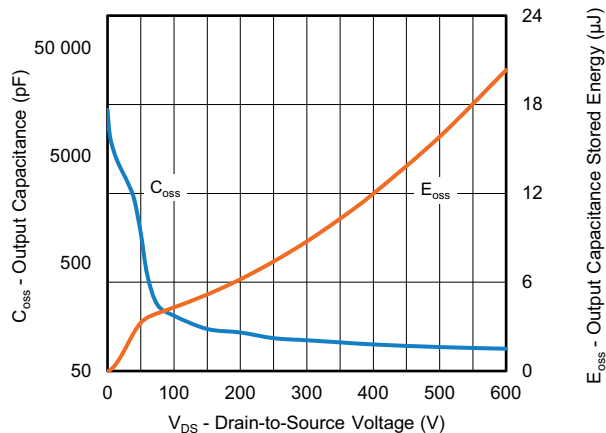
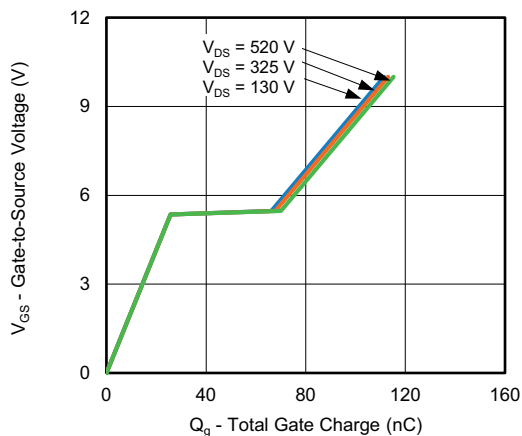
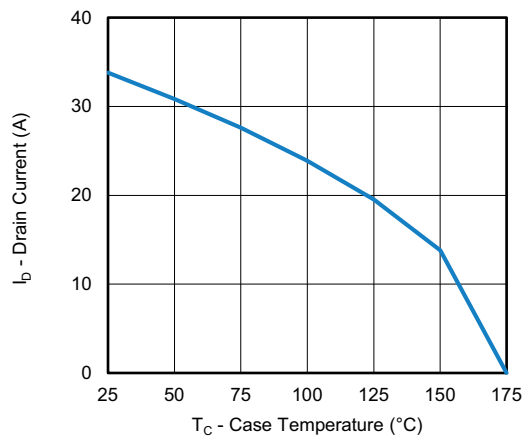
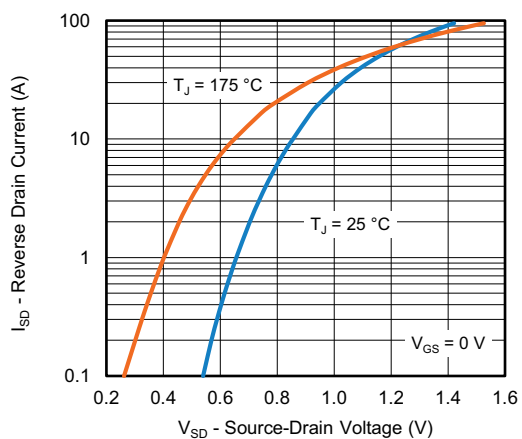
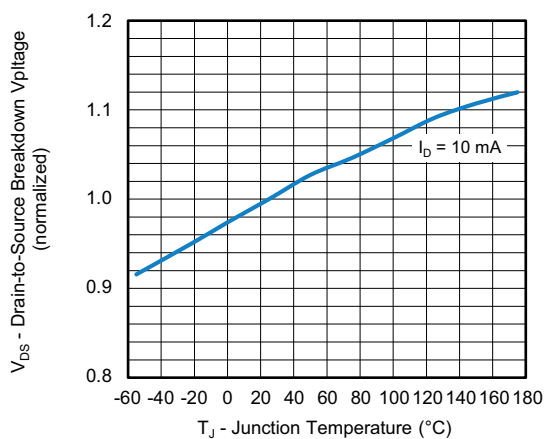
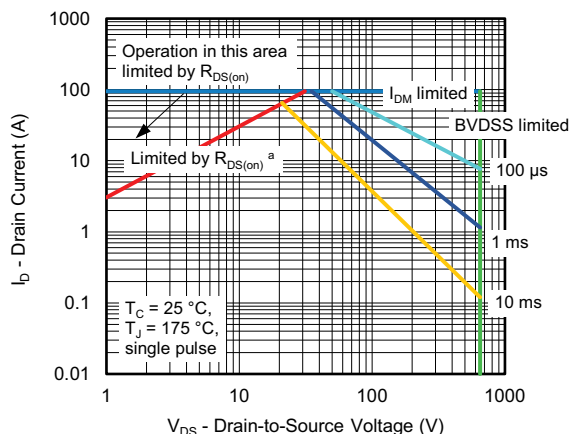
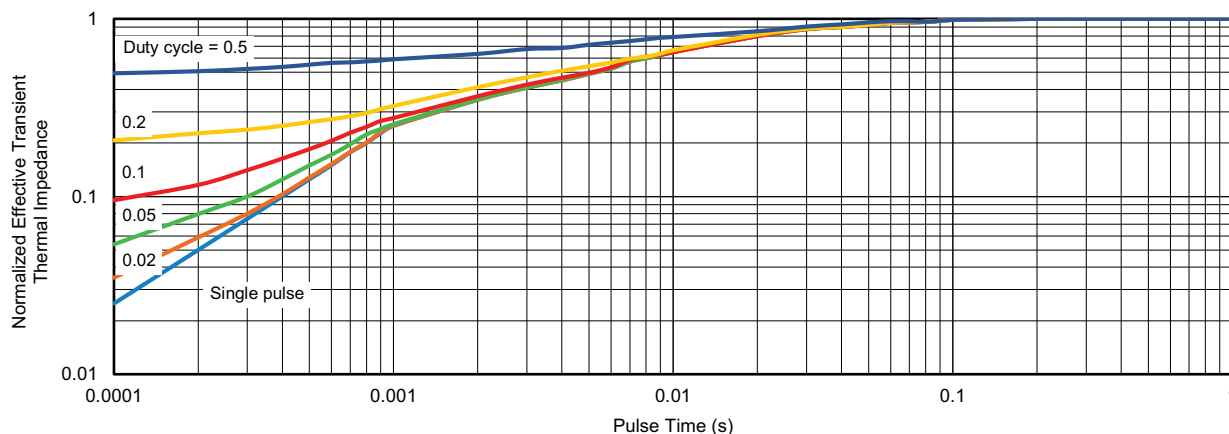
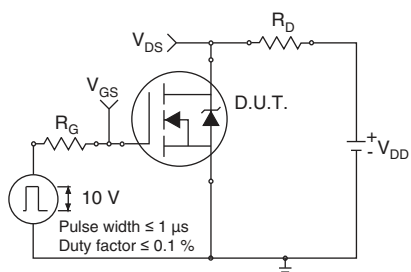
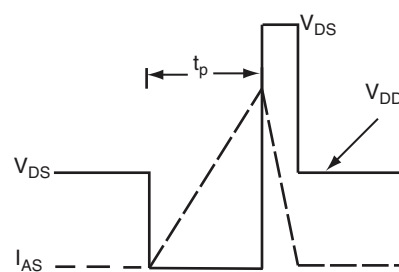
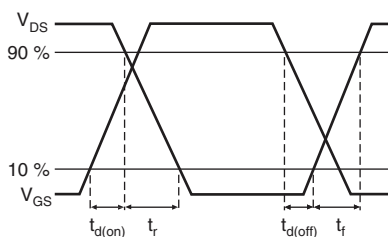
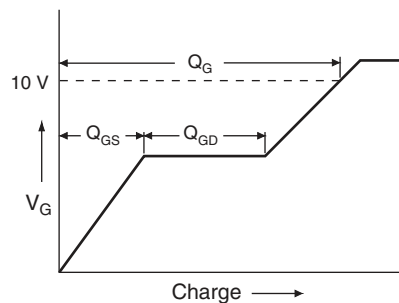
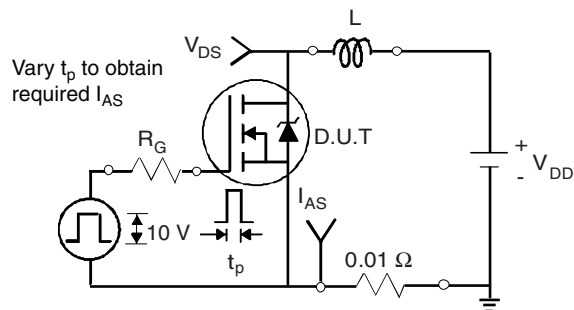
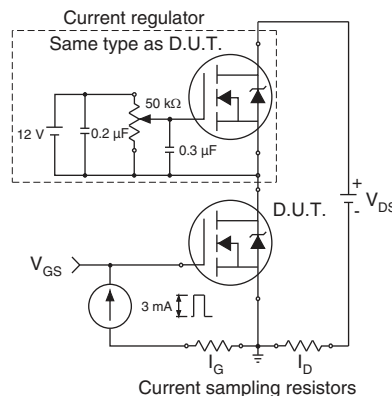
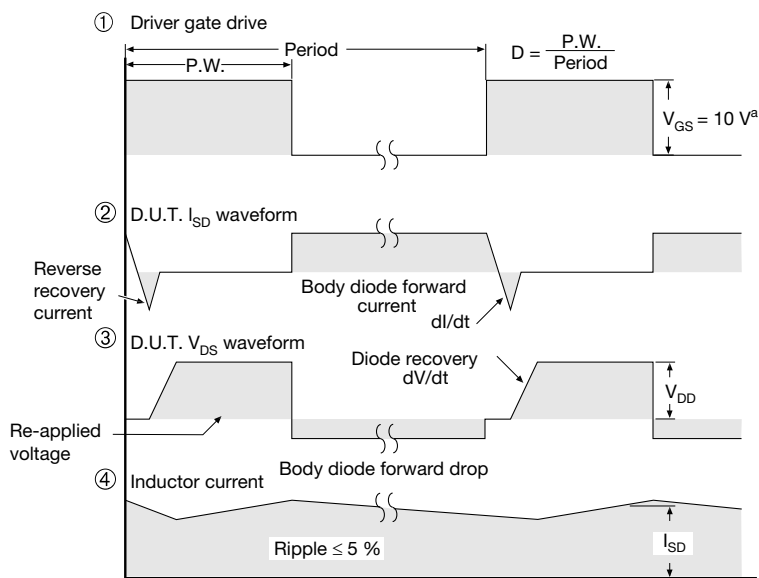
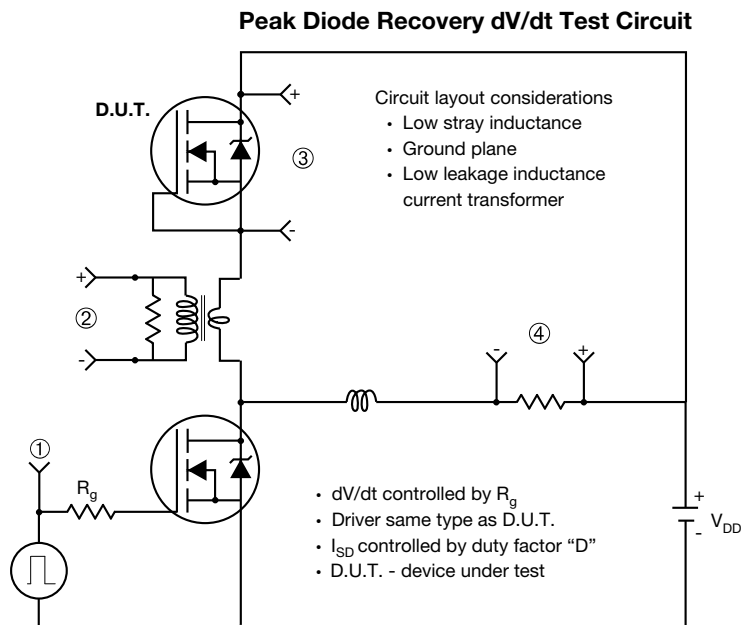


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}


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

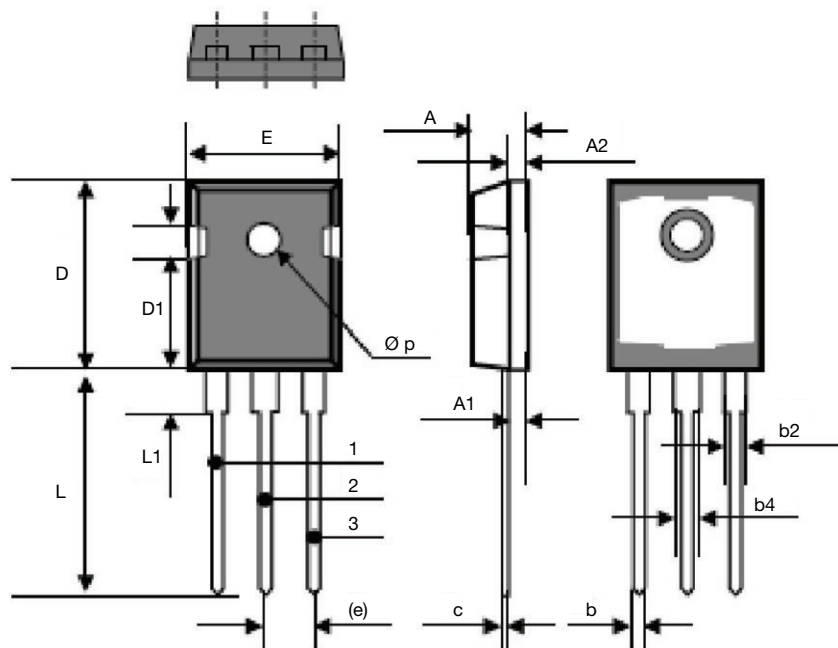

Note

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

Fig. 19 - For N-Channel

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TO-247AD (High Voltage)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.70	5.31	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.41	0.065	0.095
b4	2.59	3.43	0.102	0.135
c	0.61 BSC		0.024 BSC	
D	20.80	21.46	0.819	0.845
D1	3.68	5.49	0.145	0.216
(e)	5.46 BSC		0.215 BSC	
E	15.49	16.26	0.610	0.640
L	19.81	20.32	0.780	0.800
L1	4.06	4.50	0.160	0.177
$\varnothing p$	3.51	3.66	0.138	0.144
ECN: S17-0178-Rev. B, 06-Feb-17 DWG: 6010				



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