

EL Series Power MOSFET

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	650	
$R_{DS(on)}$ typ. at 25 °C (Ω)	$V_{GS} = 10$ V	0.171
Q_g max. (nC)	74	
Q_{gs} (nC)	15	
Q_{gd} (nC)	15	
Configuration	Single	

FEATURES

- Reduced 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

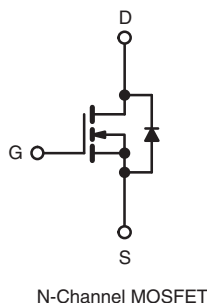
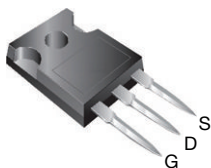


RoHS
COMPLIANT
HALOGEN
FREE

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)

TO-247AC



ORDERING INFORMATION

Package	TO-247AC
Lead (Pb)-free and Halogen-free	SiHG22N60EL-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	A
		$T_C = 100$ °C	
Pulsed Drain Current ^a	I_{DM}	45	
Linear Derating Factor		1.8	W/°C
Single Pulse Avalanche Energy ^b	E_{AS}	286	mJ
Maximum Power Dissipation	P_D	227	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	°C
Drain-Source Voltage Slope	dV/dt	62	V/ns
Reverse Diode dV/dt ^d		22	
Soldering Recommendations (Peak Temperature) ^c	for 10 s	300	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ 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}	-	0.55	

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}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^{\circ}\text{C}$, $I_D = 1\text{ mA}$	-	0.71	-	V/ $^{\circ}\text{C}$
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	-	5	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$	-	-	± 100	nA
		$V_{GS} = \pm 30\text{ V}$	-	-	± 1	μA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 480\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = 11\text{ A}$	-	0.171	0.197	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 20\text{ V}$, $I_D = 11\text{ A}$	-	6.5	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$	-	1690	-	pF
Output Capacitance	C_{oss}		-	95	-	
Reverse Transfer Capacitance	C_{rss}		-	5	-	
Effective Output Capacitance, Energy Related ^a	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 400\text{ V}$, $V_{GS} = 0\text{ V}$	-	85	-	
Effective Output Capacitance, Time Related ^b	$C_{o(tr)}$		-	296	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$, $I_D = 11\text{ A}$, $V_{DS} = 480\text{ V}$	-	37	74	nC
Gate-Source Charge	Q_{gs}		-	15	-	
Gate-Drain Charge	Q_{gd}		-	15	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 480\text{ V}$, $I_D = 11\text{ A}$, $V_{GS} = 10\text{ V}$, $R_g = 9.1\text{ }\Omega$	-	22	44	ns
Rise Time	t_r		-	46	92	
Turn-Off Delay Time	$t_{d(off)}$		-	27	54	
Fall Time	t_f		-	24	48	
Gate Input Resistance	R_g	$f = 1\text{ MHz}$, open drain	-	0.65	-	Ω
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	21	A
Pulsed Diode Forward Current	I_{SM}		-	-	45	
Diode Forward Voltage	V_{SD}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = 11\text{ A}$, $V_{GS} = 0\text{ V}$	-	-	1.2	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = I_S = 11\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_R = 25\text{ V}$	-	365	-	ns
Reverse Recovery Charge	Q_{rr}		-	5.8	-	μC
Reverse Recovery Current	I_{RRM}		-	29	-	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)

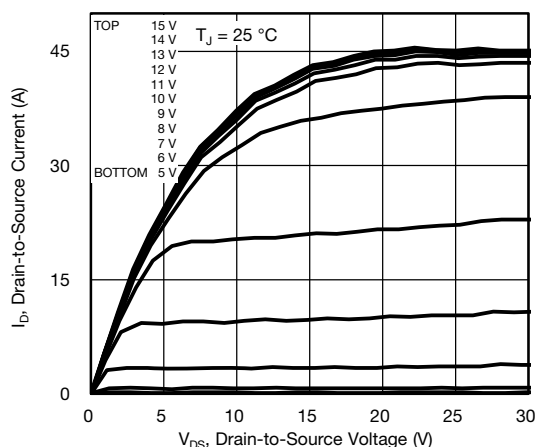


Fig. 1 - Typical Output Characteristics

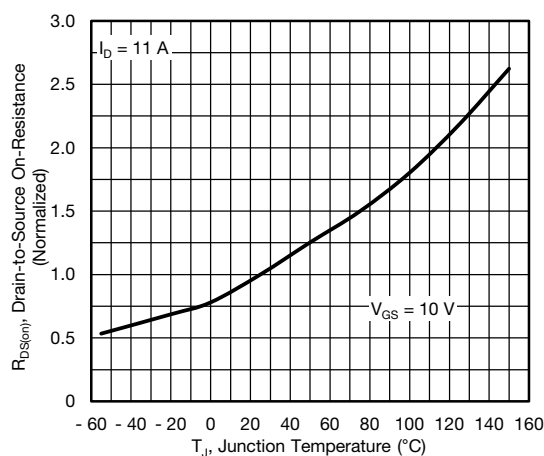


Fig. 4 - Normalized On-Resistance vs. Temperature

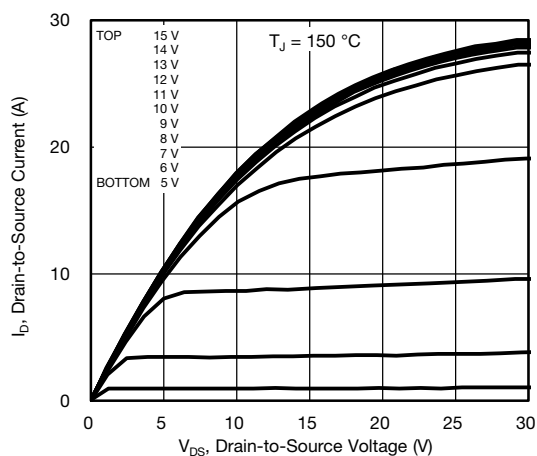


Fig. 2 - Typical Output Characteristics

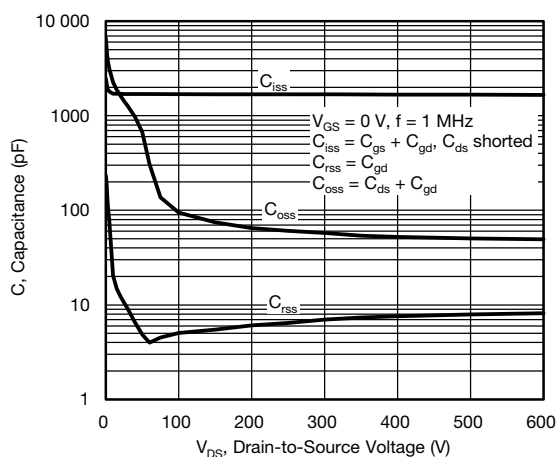


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

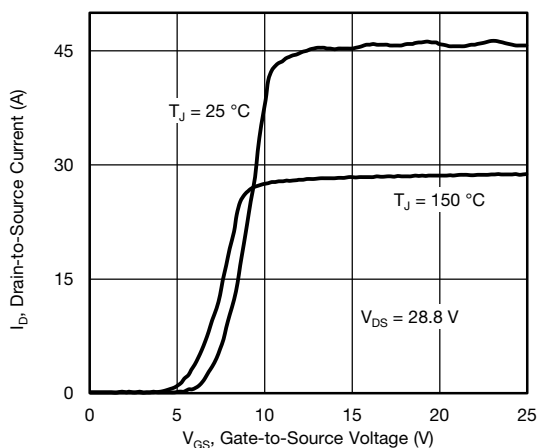


Fig. 3 - Typical Transfer Characteristics

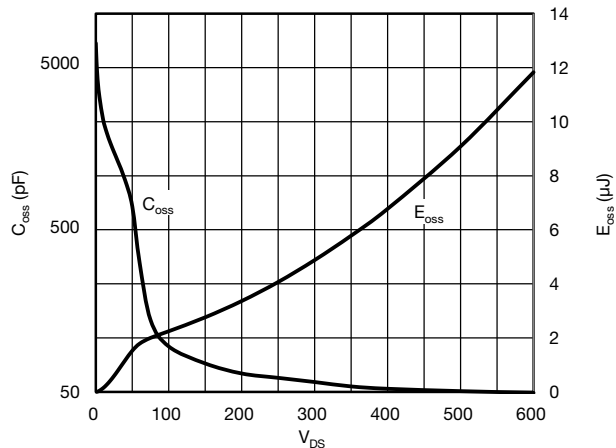
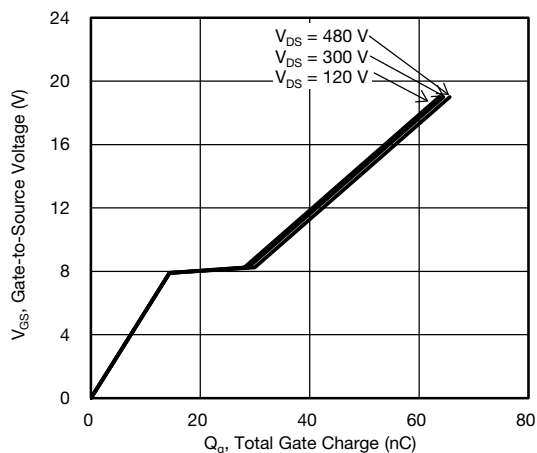
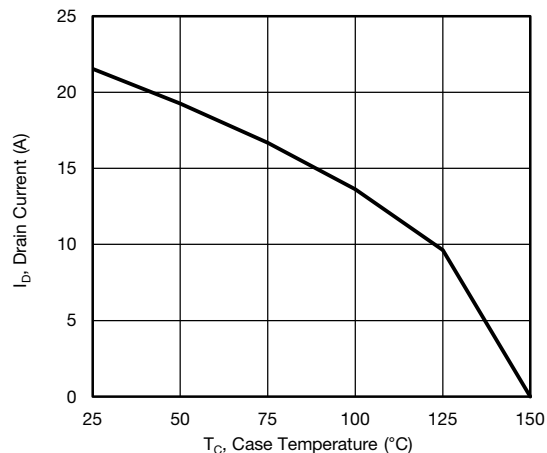
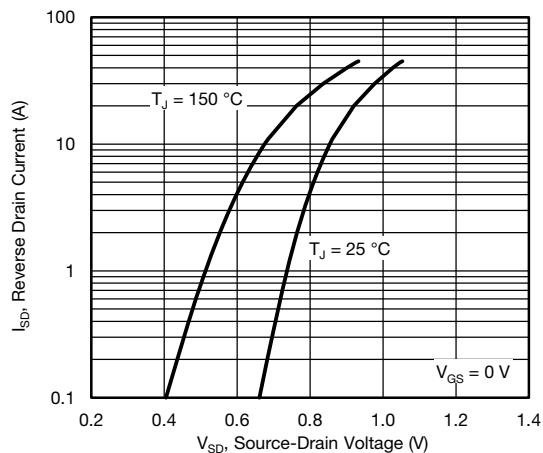
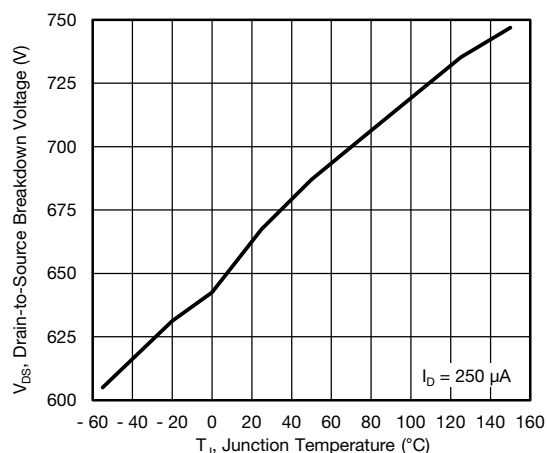
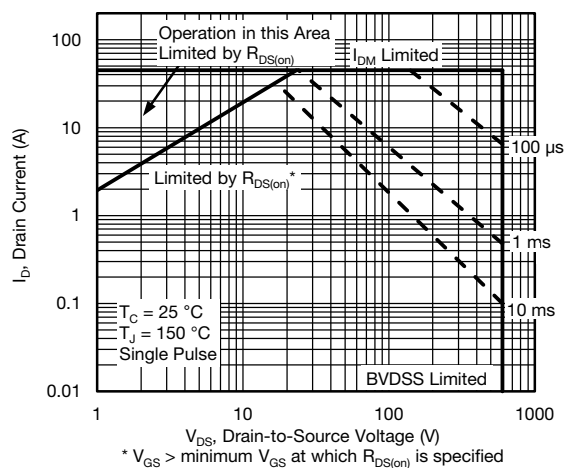
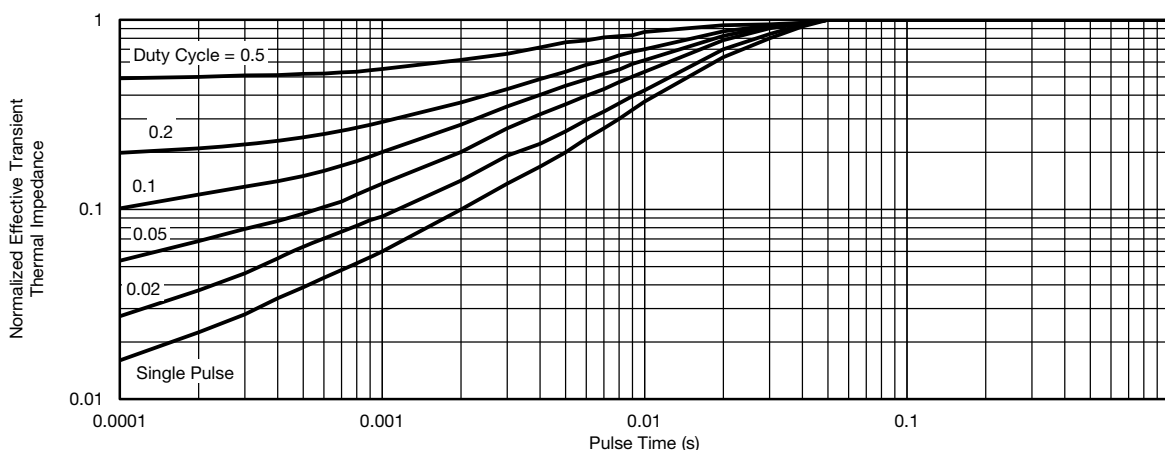
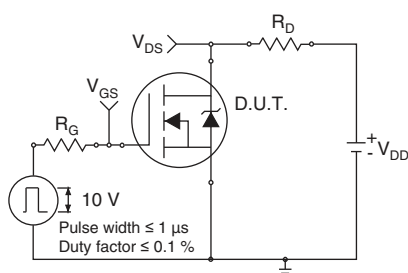
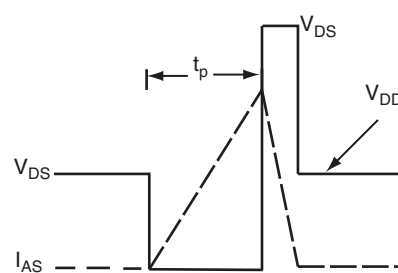
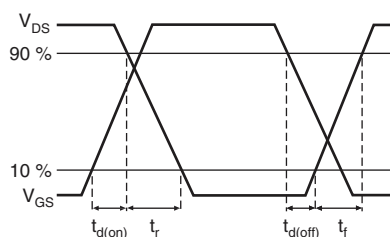
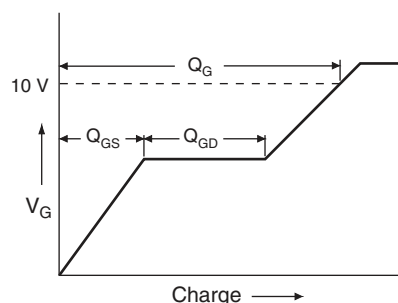
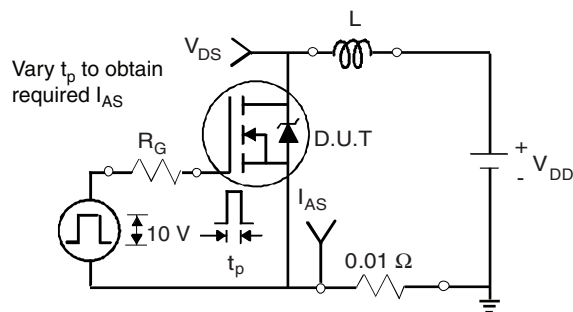
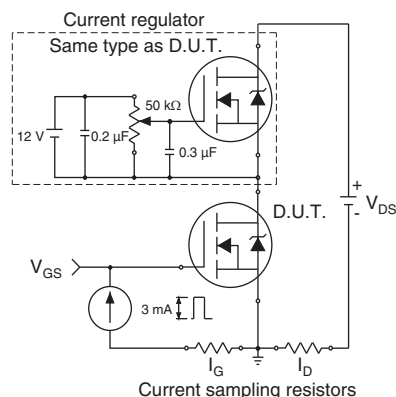


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}


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

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

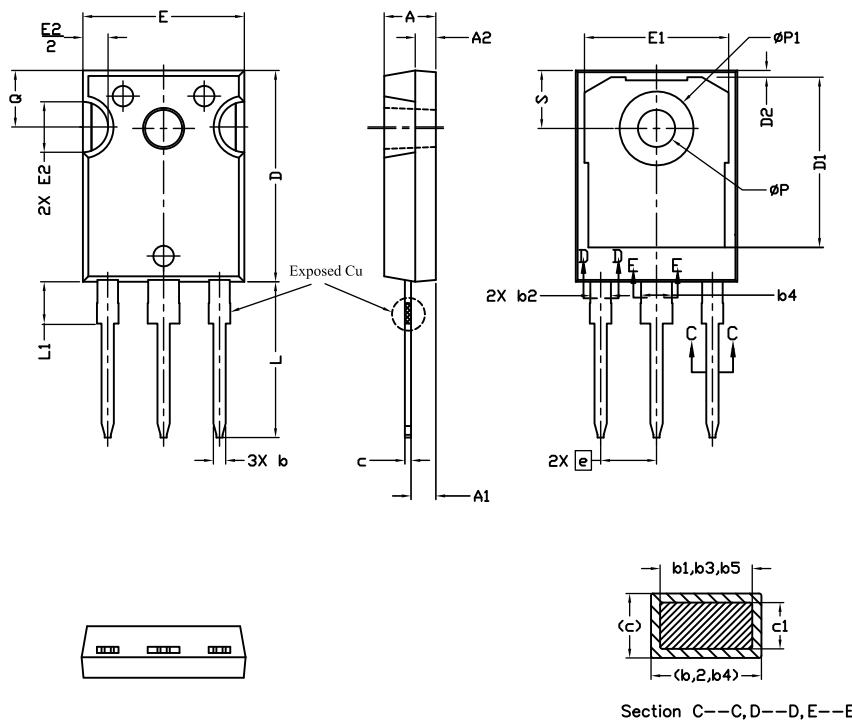
Fig. 19 - For N-Channel

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TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9



Section C---C, D---D, E---E

MILLIMETERS			
DIM.	MIN.	MAX.	NOTES
A	4.83	5.21	
A1	2.29	2.55	
A2	1.50	2.49	
b	1.12	1.33	
b1	1.12	1.28	
b2	1.91	2.39	6
b3	1.91	2.34	
b4	2.87	3.22	6, 8
b5	2.87	3.18	
c	0.55	0.69	6
c1	0.55	0.65	
D	20.40	20.70	4

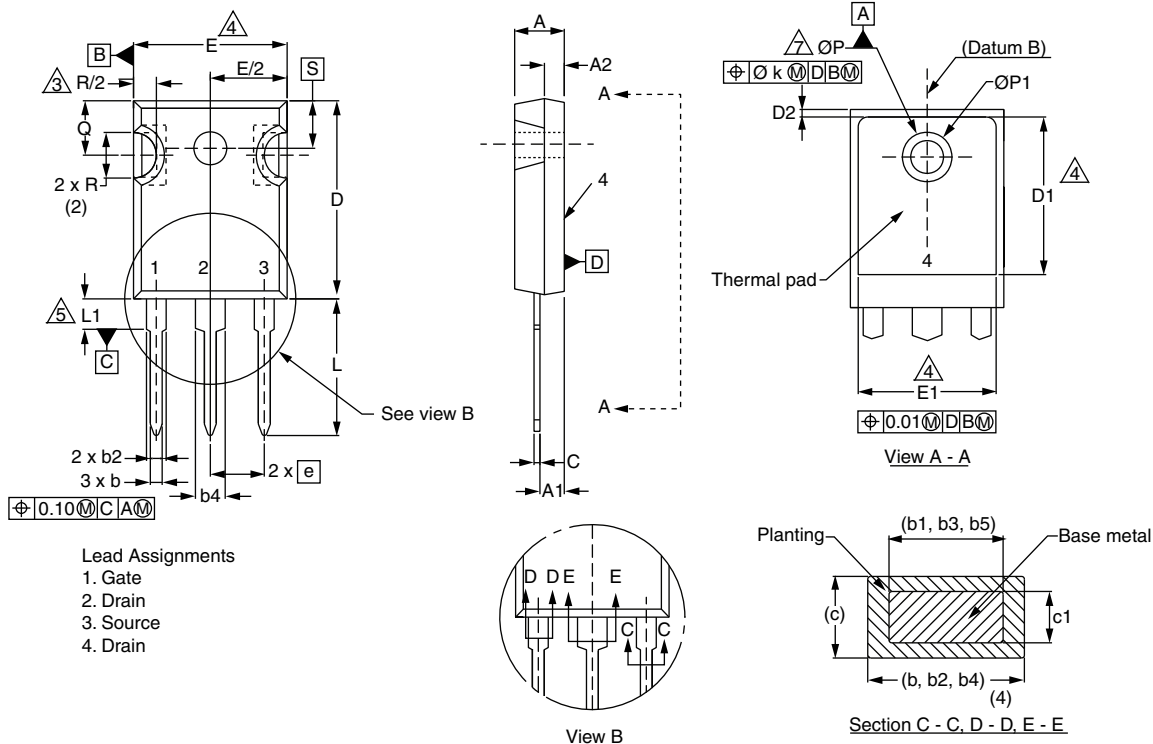
MILLIMETERS			
DIM.	MIN.	MAX.	NOTES
D1	16.25	16.85	5
D2	0.56	0.76	
E	15.50	15.87	4
E1	13.46	14.16	5
E2	4.52	5.49	3
e	5.44 BSC		
L	14.90	15.40	
L1	3.96	4.16	6
Ø P	3.56	3.65	7
Ø P1	7.19 ref.		
Q	5.31	5.69	
S	5.54	5.74	

Notes

- (1) Package reference: JEDEC® TO247, variation AC
- (2) All dimensions are in mm
- (3) Slot required, notch may be rounded
- (4) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extremes of the plastic body
- (5) Thermal pad contour optional with dimensions D1 and E1
- (6) Lead finish uncontrolled in L1
- (7) Ø P to have a maximum draft angle of 1.5° to the top of the part with a maximum hole diameter of 3.91 mm
- (8) Dimension b2 and b4 does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of b2 and b4 dimension at maximum material condition



VERSION 2: FACILITY CODE = Y



DIM.	MILLIMETERS		NOTES
	MIN.	MAX.	
A	4.58	5.31	
A1	2.21	2.59	
A2	1.17	2.49	
b	0.99	1.40	
b1	0.99	1.35	
b2	1.53	2.39	
b3	1.65	2.37	
b4	2.42	3.43	
b5	2.59	3.38	
c	0.38	0.86	
c1	0.38	0.76	
D	19.71	20.82	
D1	13.08	-	

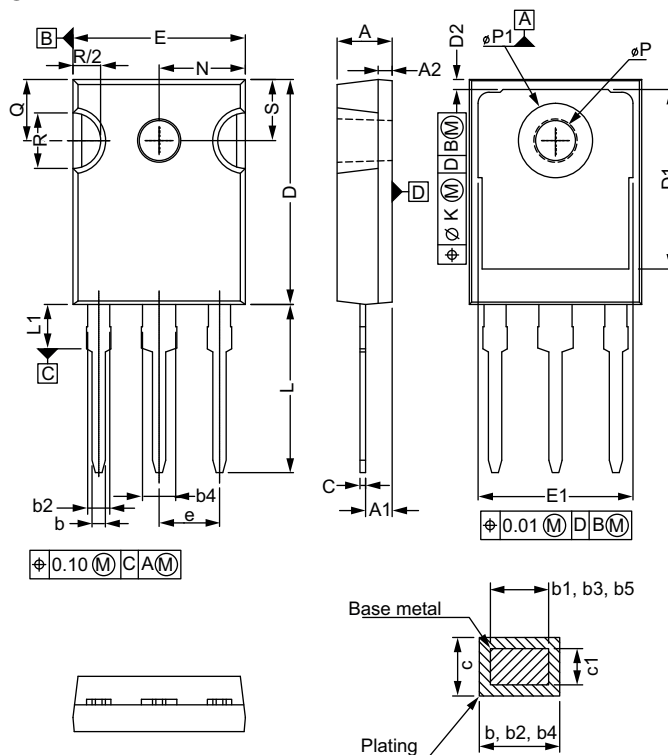
DIM.	MILLIMETERS		NOTES
	MIN.	MAX.	
D2	0.51	1.30	
E	15.29	15.87	
E1	13.72	-	
e	5.46 BSC		
Ø k	0.254		
L	14.20	16.25	
L1	3.71	4.29	
Ø P	3.51	3.66	
Ø P1	-	7.39	
Q	5.31	5.69	
R	4.52	5.49	
S	5.51 BSC		

Notes

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC outline TO-247 with exception of dimension c



VERSION 3: FACILITY CODE = N



MILLIMETERS		
DIM.	MIN.	MAX.
A	4.65	5.31
A1	2.21	2.59
A2	1.17	1.37
b	0.99	1.40
b1	0.99	1.35
b2	1.65	2.39
b3	1.65	2.34
b4	2.59	3.43
b5	2.59	3.38
c	0.38	0.89
c1	0.38	0.84
D	19.71	20.70
D1	13.08	-

MILLIMETERS		
DIM.	MIN.	MAX.
D2	0.51	1.35
E	15.29	15.87
E1	13.46	-
e	5.46 BSC	
k	0.254	
L	14.20	16.10
L1	3.71	4.29
N	7.62 BSC	
P	3.56	3.66
P1	-	7.39
Q	5.31	5.69
R	4.52	5.49
S	5.51 BSC	

ECN: E20-0545-Rev. F, 19-Oct-2020
DWG: 5971

Notes

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")



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