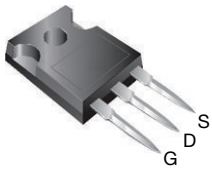
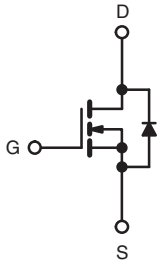
S Series Power MOSFET

PRODUCT SUMMARY		
V_{DS} at T_J max. (V)	650	
$R_{DS(on)}$ max. at 25 °C (Ω)	V_{GS} = 10 V	0.190
Q_g max. (nC)	98	
Q_{gs} (nC)	17	
Q_{gd} (nC)	25	
Configuration	Single	

TO-247AC





N-Channel MOSFET

FEATURES

- Generation one
- High E_{AR} capability
- Lower figure-of-merit R_{on} x Q_g
- 100 % avalanche tested
- Ultra low R_{on}
- dV/dt ruggedness
- Ultra low gate charge (Q_g)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE Available

APPLICATIONS

- PFC power supply stages
- Hard switching topologies
- Solar inverters
- UPS
- Motor control
- Lighting
- Server telecom

ORDERING INFORMATION	
Package	TO-247AC
Lead (Pb)-free	SiHG22N60S-E3
Lead (Pb)-free and Halogen-free	SiHG22N60S-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	V_{GS} at 10 V	T_C = 25 °C	I_D	22	A
		T_C = 100 °C		13	
Pulsed Drain Current [a]			I_{DM}	65	
Linear Derating Factor		TO-247		2	W/°C
Single Pulse Avalanche Energy [b]			E_{AS}	690	mJ
Repetitive Avalanche Energy [a]			E_{AR}	25	
Maximum Power Dissipation		TO-247	P_D	250	W
Drain-Source Voltage Slope	T_J = 125 °C		dV/dt	37	V/ns
Reverse Diode dV/dt [d]				5.3	
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +150	°C
Soldering Recommendations (Peak Temperature) [c]	for 10 s			300	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature.
b. V_{DD} = 50 V, starting T_J = 25 °C, L = 28.2 mH, R_g = 25 Ω, I_{AS} = 7 A.
c. 1.6 mm from case.
d. $I_{SD} \leq I_D$, dI/dt = 100 A/µs, starting T_J = 25 °C.

THERMAL RESISTANCE RATINGS					
PARAMETER		**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	TO-247	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	TO-247	R_{thJC}	-	0.5	

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 = 1 mA		600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA		-	0.70	-	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} = 600 V, V_{GS} = 0 V		-	-	1	µA
		V_{DS} = 600 V, V_{GS} = 0 V, T_J = 150 °C		-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 11 A	-	0.160	0.190	Ω
Forward Transconductance [a]	g_{fs}	V_{DS} = 50 V, I_D = 13 A		-	9.4	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz		562	2810	5620	pF
Output Capacitance	C_{oss}			296	1480	2960	
Reverse Transfer Capacitance	C_{rss}			6.6	33	66	
Total Gate Charge	Q_g	V_{GS} = 10 V	I_D = 22 A, V_{DS} = 480 V	-	75	110	nC
Gate-Source Charge	Q_{gs}			-	17	-	
Gate-Drain Charge	Q_{gd}			-	25	-	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 380 V, I_D = 22 A, R_g = 9.1 Ω, V_{GS} = 10 V		-	24	50	ns
Rise Time	t_r			-	68	100	
Turn-Off Delay Time	$t_{d(off)}$			-	77	115	
Fall Time	t_f			-	59	90	
Gate Input Resistance	R_g	f = 1 MHz, open drain		0.13	0.65	1.3	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	22	A
Pulsed Diode Forward Current	I_{SM}			-	-	65	
Diode Forward Voltage	V_{SD}	T_J = 25 °C, I_S = 22 A, V_{GS} = 0 V		-	-	1.2	V
Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = I_S, dI/dt = 100 A/µs, V_R = 25 V		-	462	-	ns
Reverse Recovery Charge	Q_{rr}			-	8.3	-	µC
Reverse Recovery Current	I_{RRM}			-	30	-	A

Note

a. $C_{oss\ eff.}$ (TR) is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

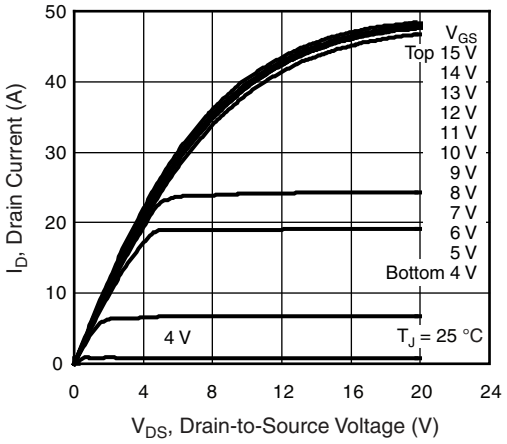


Fig. 1 - Typical Output Characteristics, T_J = 25 °C

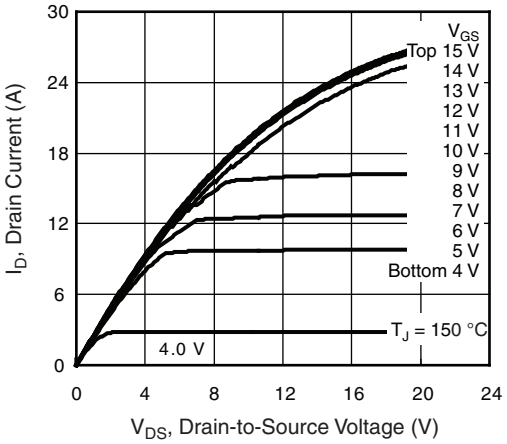


Fig. 2 - Typical Output Characteristics, T_J = 150 °C

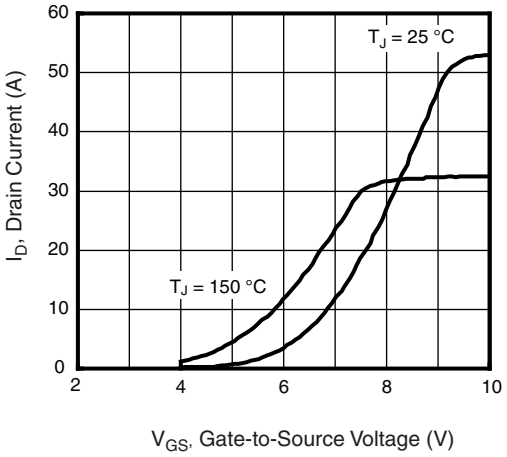


Fig. 3 - Typical Transfer Characteristics

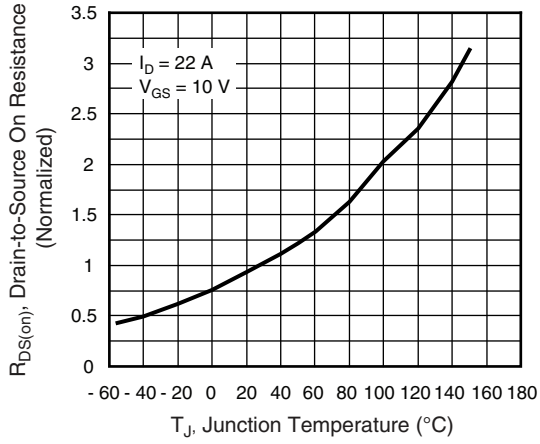


Fig. 4 - Normalized On-Resistance vs. Temperature

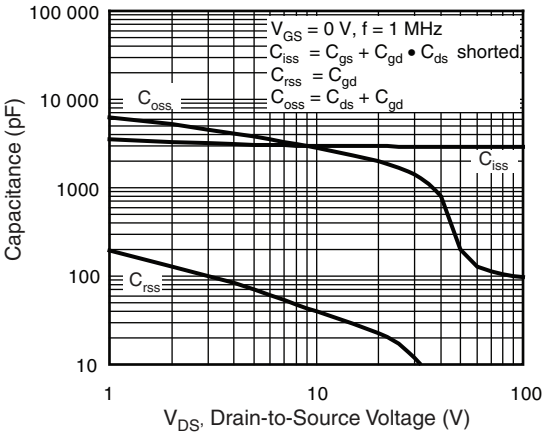


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

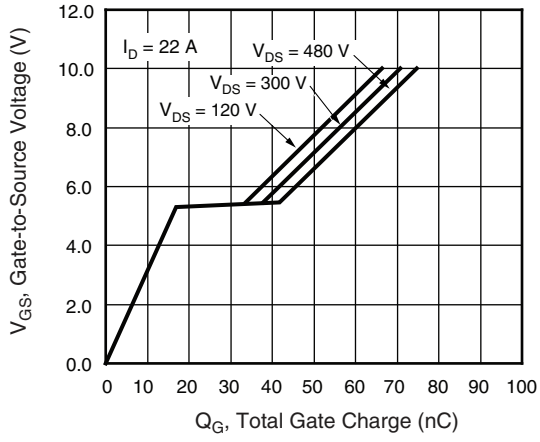


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

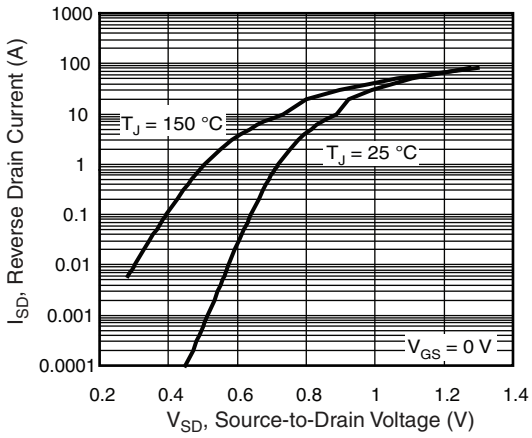


Fig. 7 - Typical Source-Drain Diode Forward Voltage

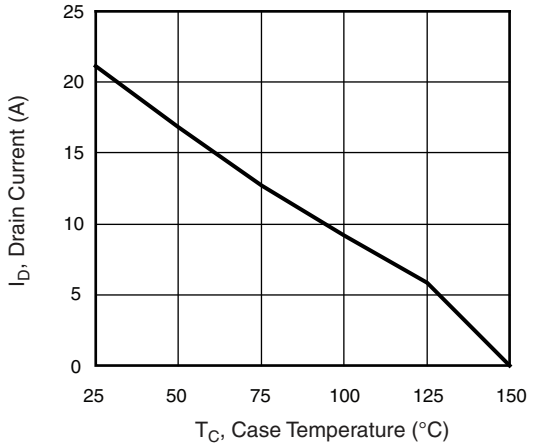


Fig. 9 - Maximum Drain Current vs. Case Temperature

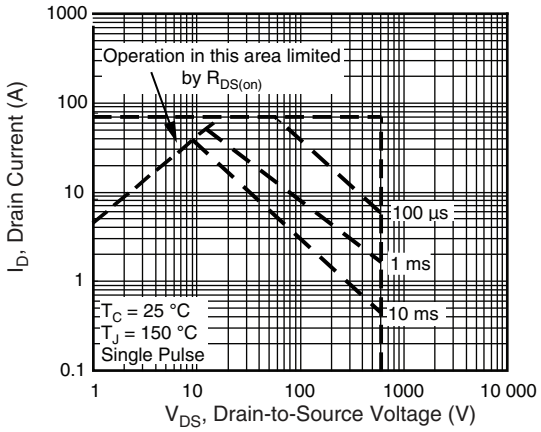


Fig. 8 - Maximum Safe Operating Area

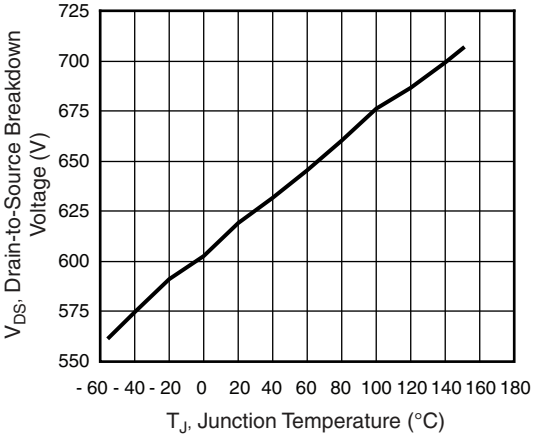


Fig. 10 - Drain-to-Source Breakdown Voltage

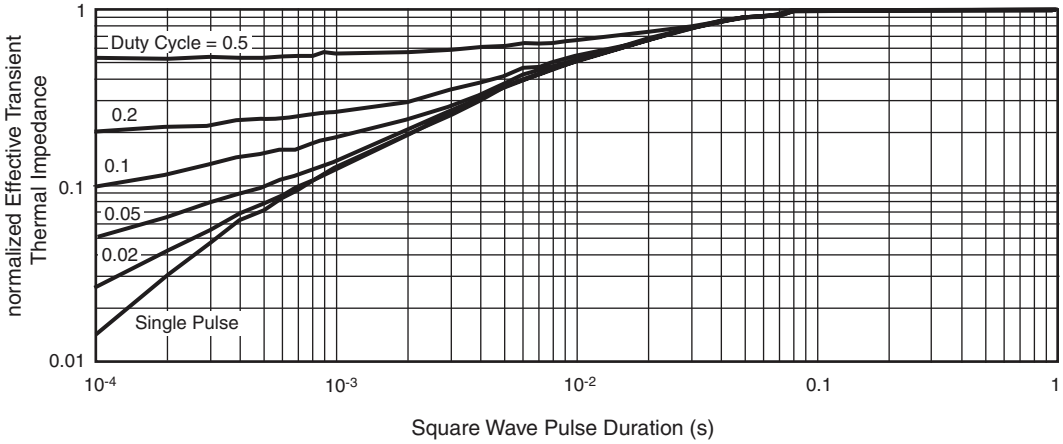


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case

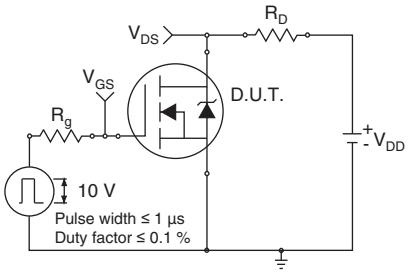


Fig. 12 - Switching Time Test Circuit

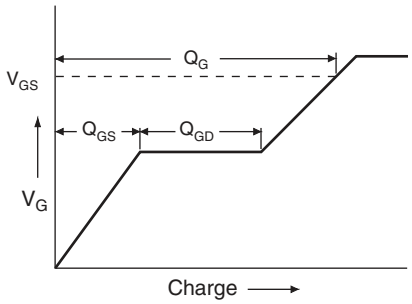


Fig. 16 - Basic Gate Charge Waveform

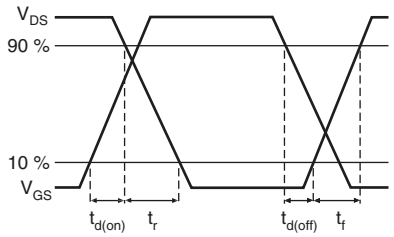


Fig. 13 - Switching Time Waveforms

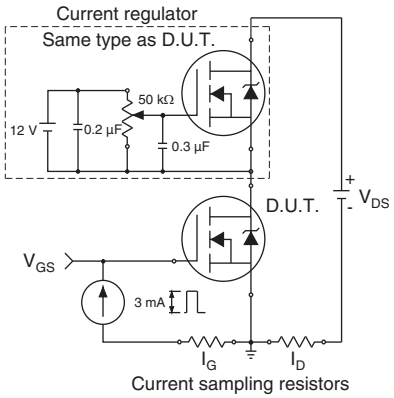


Fig. 17 - Gate Charge Test Circuit

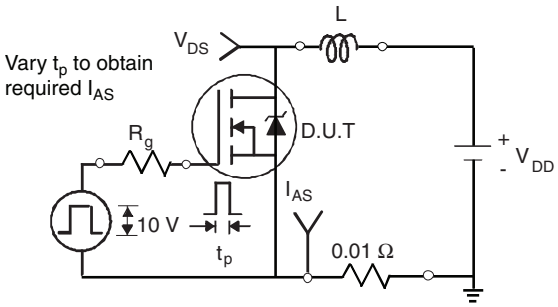


Fig. 14 - Unclamped Inductive Test Circuit

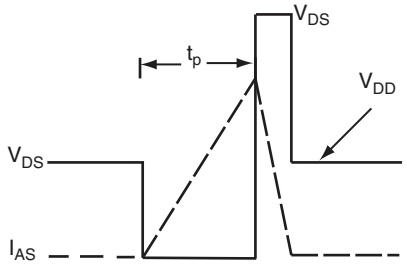
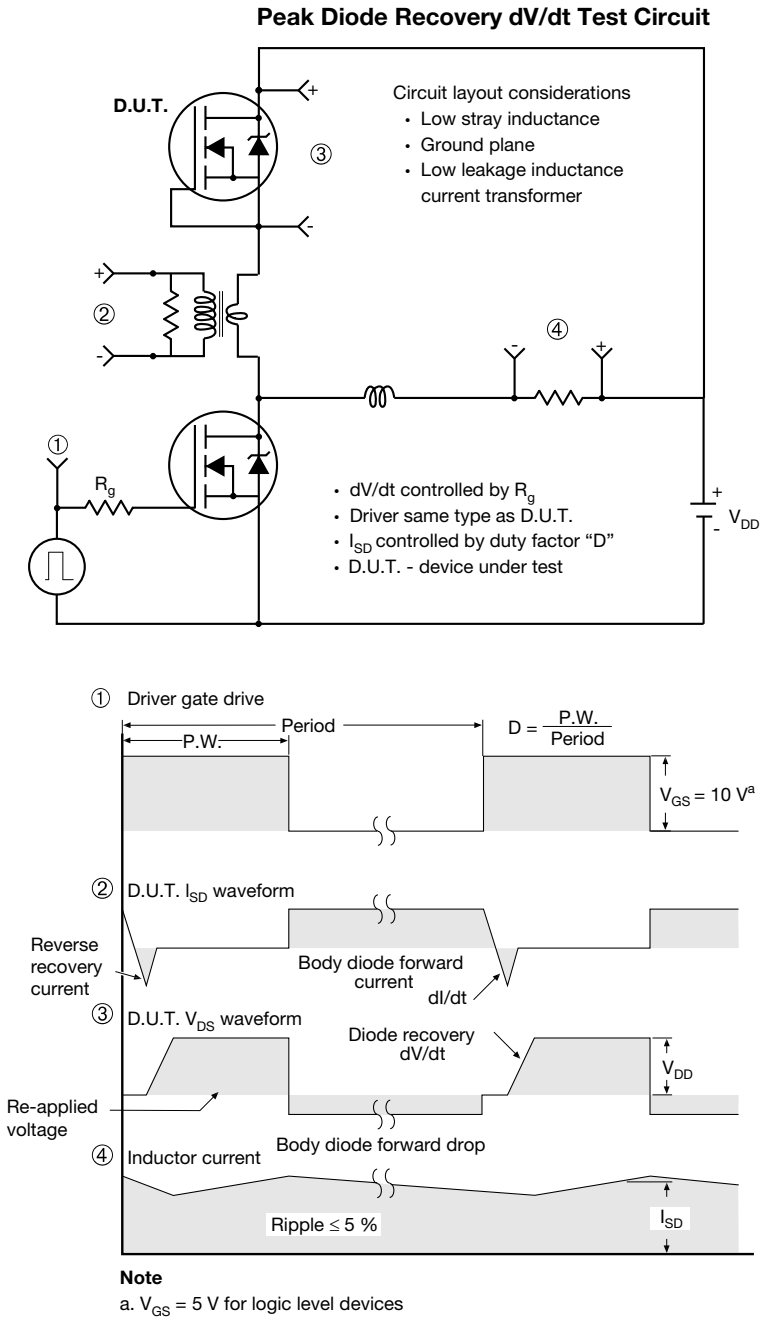


Fig. 15 - Unclamped Inductive Waveforms



Note

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

Fig. 18 - For N-Channel

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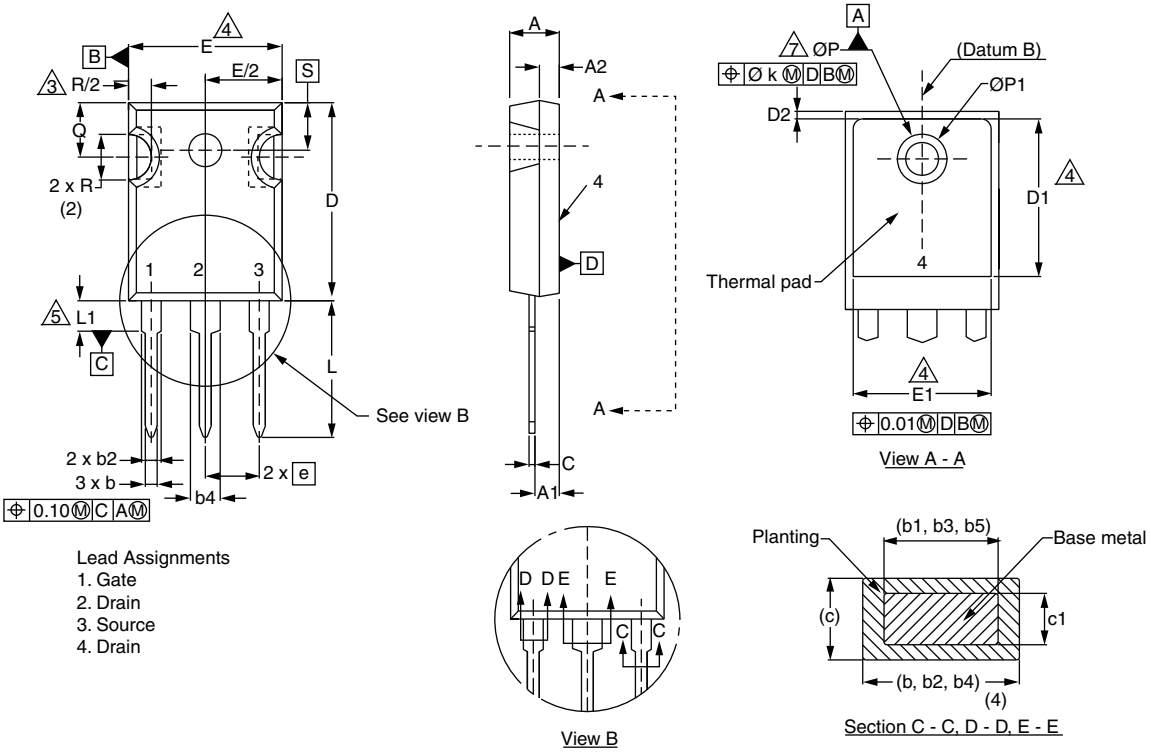
TO-247AC (High Voltage)



Lead Assignments
1. Gate
2. Drain
3. Source
4. Drain

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
A	4.58	5.31	0.180	0.209
A1	2.21	2.59	0.087	0.102
A2	1.17	2.49	0.046	0.098
b	0.99	1.40	0.039	0.055
b1	0.99	1.35	0.039	0.053
b2	1.53	2.39	0.060	0.094
b3	1.65	2.37	0.065	0.093
b4	2.42	3.43	0.095	0.135
b5	2.59	3.38	0.102	0.133
c	0.38	0.86	0.015	0.034
c1	0.38	0.76	0.015	0.030
D	19.71	20.82	0.776	0.820
D1	13.08	-	0.515	-

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D2	0.51	1.30	0.020	0.051
E	15.29	15.87	0.602	0.625
E1	13.72	-	0.540	-
e	5.46 BSC		0.215 BSC	
Ø k	0.254		0.010	
L	14.20	16.25	0.559	0.640
L1	3.71	4.29	0.146	0.169
N	7.62 BSC		0.300 BSC	
Ø P	3.51	3.66	0.138	0.144
Ø P1	-	7.39	-	0.291
Q	5.31	5.69	0.209	0.224
R	4.52	5.49	0.178	0.216
S	5.51 BSC		0.217 BSC	

ECN: X13-0103-Rev. D, 01-Jul-13
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").
7. Outline conforms to JEDEC outline TO-247 with exception of dimension c.
8. Xian and Mingxin actually photo.

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