

## E Series Power MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V) at $T_J$ max.	650	
$R_{DS(on)}$ max. at 25 °C ( $\Omega$ )	$V_{GS} = 10$ V	0.064
$Q_g$ max. (nC)	220	
$Q_{gs}$ (nC)	36	
$Q_{gd}$ (nC)	60	
Configuration	Single	

### FEATURES

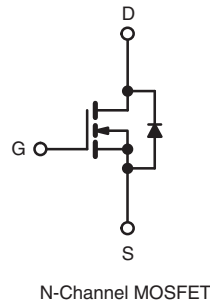
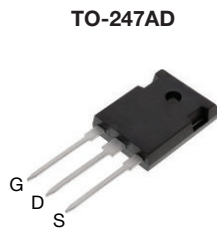
- Low Figure-of-Merit (FOM)  $R_{on} \times Q_g$
- Low Input Capacitance ( $C_{iss}$ )
- Reduced Switching and Conduction Losses
- Ultra Low Gate Charge ( $Q_g$ )
- Avalanche Energy Rated (UIS)
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- 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	TO-247AD
Lead (Pb)-free and Halogen-free	SiHW47N60E-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	$V_{GS}$	$\pm 20$	
Gate-Source Voltage AC ( $f > 1$ Hz)		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 <sup>a</sup>	$I_{DM}$	145	
Linear Derating Factor		3	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	1800	mJ
Maximum Power Dissipation	$P_D$	357	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	°C
Drain-Source Voltage Slope	$dV/dt$	$T_J = 125$ °C	V/ns
Reverse Diode $dV/dt^d$		11	
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s	300	°C

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 73.5$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 7$  A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu$ 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)	$R_{thJC}$	-	0.33	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
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 $25\text{ }^\circ\text{C}, I_D = 250\text{ }\mu\text{A}$		-	0.66	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.5	-	3.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$		-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 24\text{ A}$	-	0.053	0.064	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 8\text{ V}, I_D = 3\text{ A}$		-	6.8	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$		-	4810	-	pF
Output Capacitance	$C_{oss}$			-	230	-	
Reverse Transfer Capacitance	$C_{rss}$			-	5	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 24\text{ A}, V_{DS} = 480\text{ V}$	-	147	220	nC
Gate-Source Charge	$Q_{gs}$			-	36	-	
Gate-Drain Charge	$Q_{gd}$			-	60	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 480\text{ V}, I_D = 24\text{ A}, V_{GS} = 10\text{ V}, R_g = 4.4\text{ }\Omega$		-	24	50	ns
Rise Time	$t_r$			-	11	25	
Turn-Off Delay Time	$t_{d(off)}$			-	94	140	
Fall Time	$t_f$			-	13	26	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}, \text{open drain}$		-	0.65	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode		-	-	47	A
Pulsed Diode Forward Current	$I_{SM}$			-	-	140	
Diode Forward Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 24\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 24\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$		-	696	-	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			-	16	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$			-	39	-	A

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

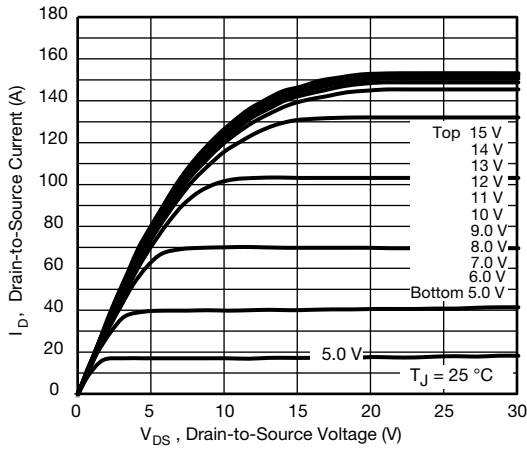


Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ °C}$

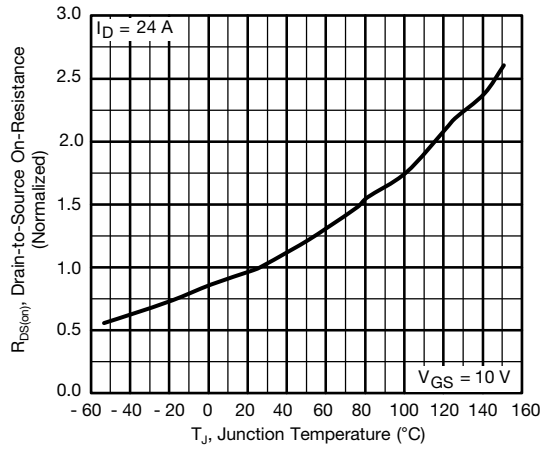


Fig. 4 - Normalized On-Resistance vs. Temperature

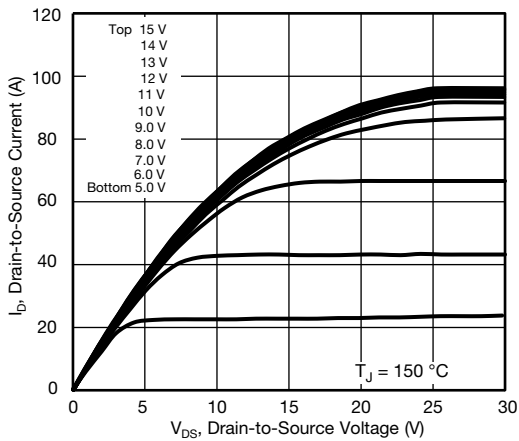


Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ °C}$

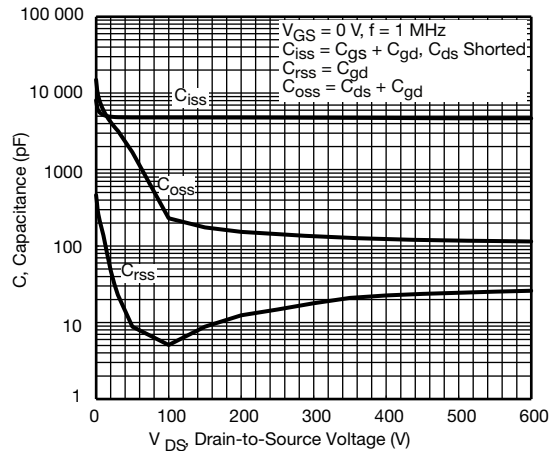


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

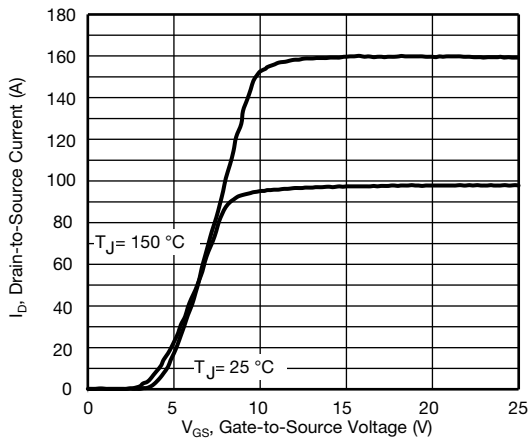


Fig. 3 - Typical Transfer Characteristics

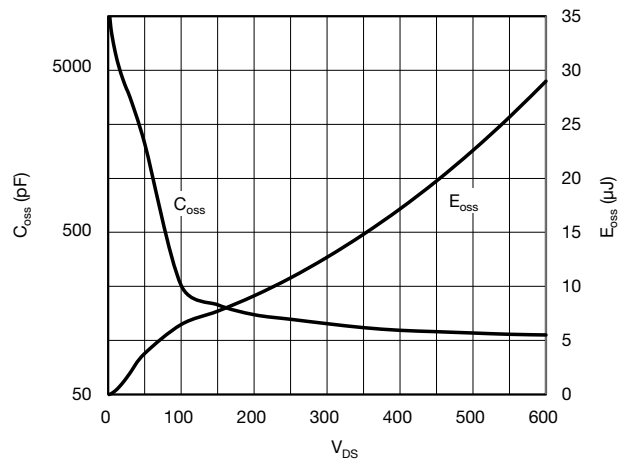


Fig. 6 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$

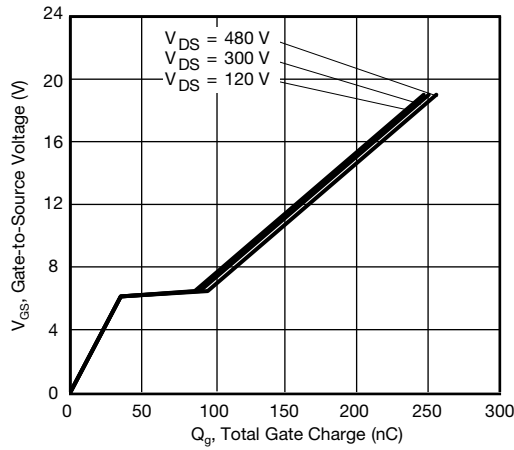


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

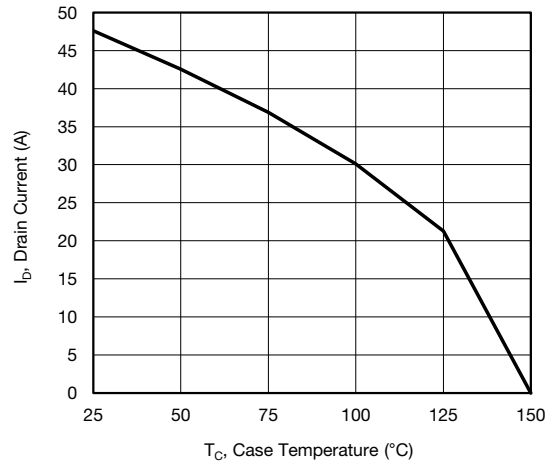


Fig. 10 - Maximum Drain Current vs. Case Temperature

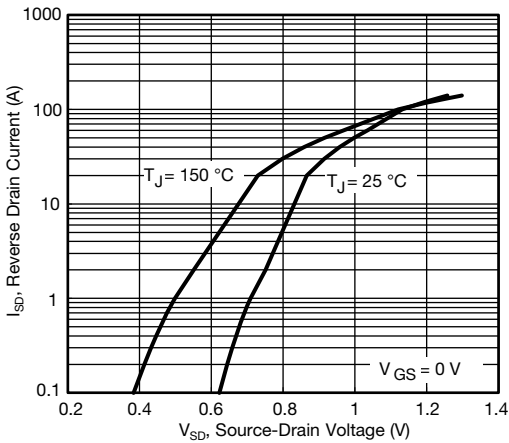


Fig. 8 - Typical Source-Drain Diode Forward Voltage

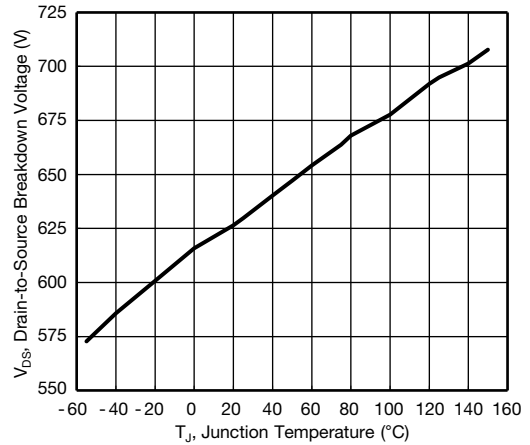


Fig. 11 - Temperature vs. Drain-to-Source Voltage

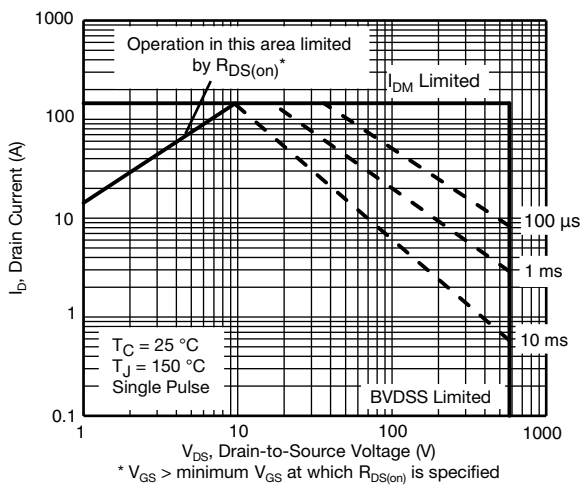


Fig. 9 - Maximum Safe Operating Area

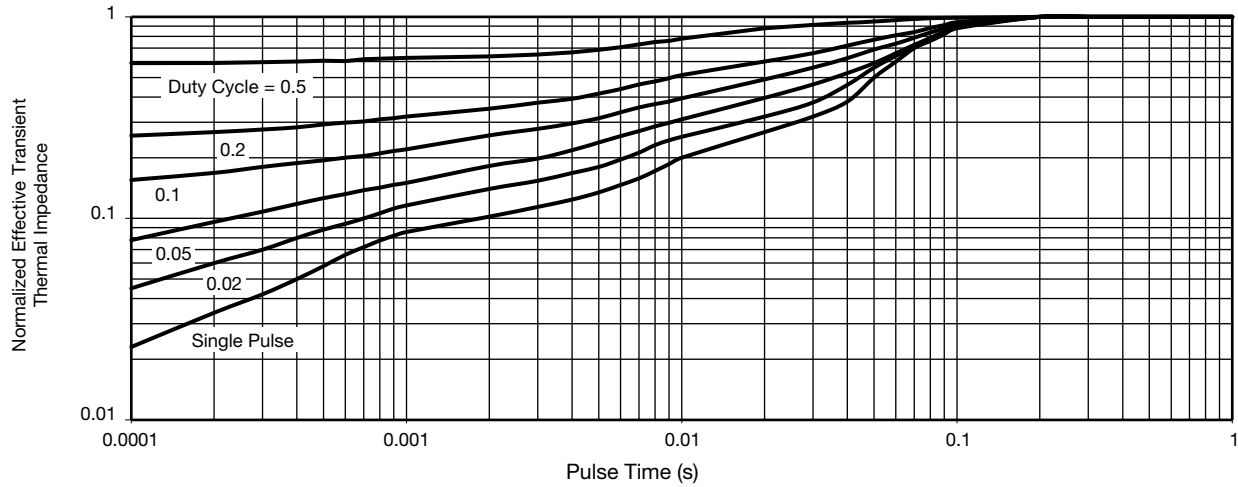


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

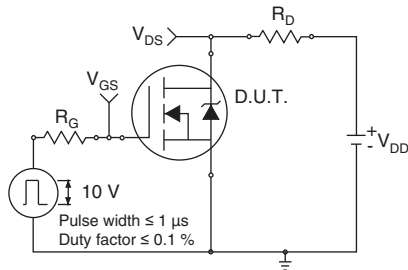


Fig. 13 - Switching Time Test Circuit

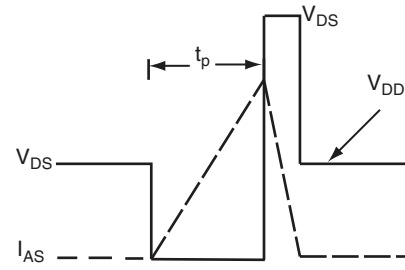


Fig. 16 - Unclamped Inductive Waveforms

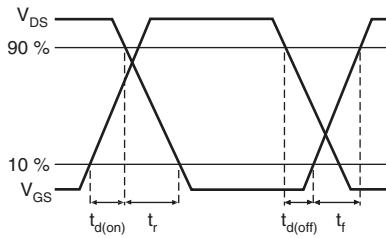


Fig. 14 - Switching Time Waveforms

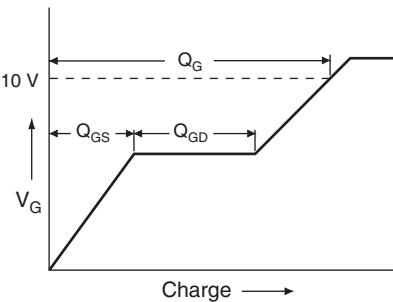


Fig. 17 - Basic Gate Charge Waveform

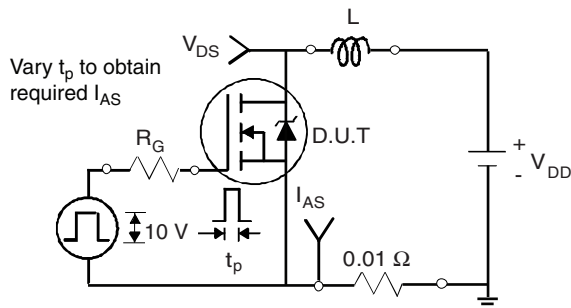


Fig. 15 - Unclamped Inductive Test Circuit

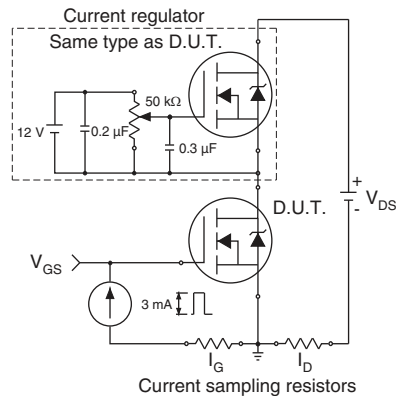


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

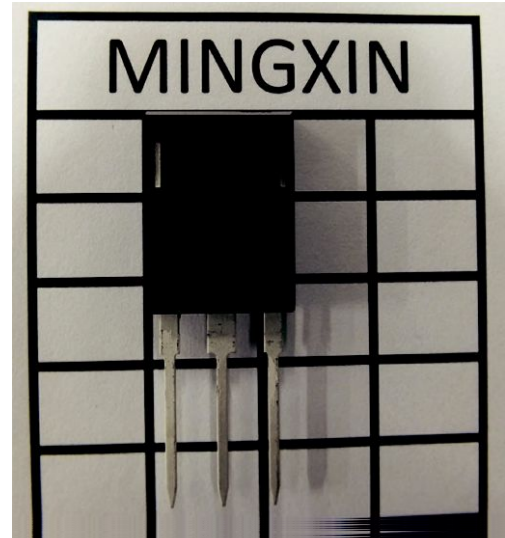
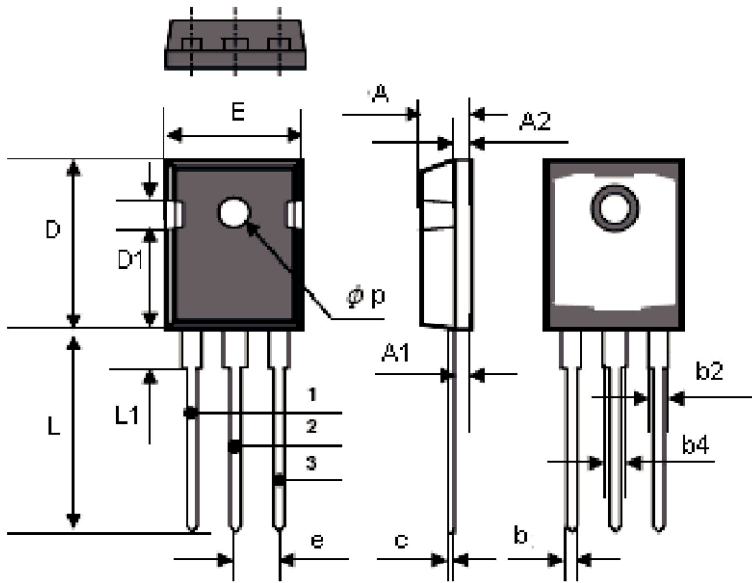
a.  $V_{GS} = 5 V$  for logic level devices

Fig. 19 - For N-Channel

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**TO-247AD (HIGH VOLTAGE)**



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.90	5.10	0.193	0.200
A1	2.30	2.40	0.090	0.094
A2	1.92	2.08	0.076	0.082
b	1.15	1.25	0.045	0.049
b2	1.95	2.05	0.077	0.081
b4	2.85	3.11	0.112	0.122
c	0.6 BSC		0.024 BSC	
D	20.80	21.46	0.819	0.845
D1	4.37	4.63	0.172	0.182
e	5.32	5.58	0.209	0.220
E	15.77	16.03	0.621	0.631
L	19.85	20.11	0.781	0.792
L1	4.07	4.33	0.160	0.170
Ø p	3.56	3.66	0.140	0.144

ECN: X12-0191-Rev. A, 22-Oct-12  
 DWG: 6010



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