

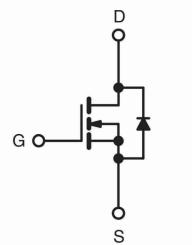
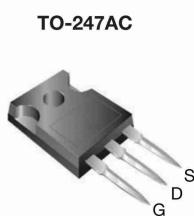
# STW58N65DM2AG-VB Datasheet

SJ\_Multi-EPI TO247 Single-N 650V MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V) at $T_J$ max.	700
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 10$ V 0.06
$Q_g$ max. (nC)	273
$Q_{gs}$ (nC)	46
$Q_{gd}$ (nC)	79
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)



N-Channel MOSFET

## 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)

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	47
		$T_C = 100$ °C	30
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	142	A
Linear Derating Factor		3.3	
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	1410	mJ
Maximum Power Dissipation	$P_D$	415	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	37
Reverse Diode dV/dt <sup>d</sup>			9
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,  $L = 28.2$  mH,  $R_g = 25$  Ω,  $I_{AS} = 10$  A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/μs, starting  $T_J = 25$  °C.

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	40	$^{\circ}\text{C}/\text{W}$
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.3	

 **SPECIFICATIONS (T<sub>J</sub> = 25 °C, unless otherwise noted)**

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$		650	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1 \text{ mA}$		-	0.70	-	$\text{V}/^{\circ}\text{C}$
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$		2	-	4	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20 \text{ V}$		-	-	$\pm 100$	nA
		$V_{GS} = \pm 30 \text{ V}$		-	-	$\pm 1$	$\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650 \text{ V}$ , $V_{GS} = 0 \text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 520 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 125 \text{ }^{\circ}\text{C}$		-	-	25	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10 \text{ V}$	$I_D = 24 \text{ A}$	-	0.06	-	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 30 \text{ V}$ , $I_D = 24 \text{ A}$		-	16.7	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0 \text{ V}$ , $V_{DS} = 100 \text{ V}$ , $f = 1 \text{ MHz}$		-	5682	-	pF
Output Capacitance	$C_{oss}$			-	251	-	
Reverse Transfer Capacitance	$C_{rss}$			-	1	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$			-	192	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$			-	665	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10 \text{ V}$	$I_D = 24 \text{ A}$ , $V_{DS} = 520 \text{ V}$	-	182	273	nC
Gate-Source Charge	$Q_{gs}$			-	46	-	
Gate-Drain Charge	$Q_{gd}$			-	79	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520 \text{ V}$ , $I_D = 6 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_g = 9.1 \Omega$		-	47	94	ns
Rise Time	$t_r$			-	87	131	
Turn-Off Delay Time	$t_{d(off)}$			-	156	234	
Fall Time	$t_f$			-	103	206	
Gate Input Resistance	$R_g$	$f = 1 \text{ MHz}$ , open drain		-	0.64	-	$\Omega$
<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	$I_{SM}$			-	-	139	
Diode Forward Voltage	$V_{SD}$	$T_J = 25 \text{ }^{\circ}\text{C}$ , $I_S = 24 \text{ A}$ , $V_{GS} = 0 \text{ V}$		-	0.9	1.2	V
Reverse Recovery Time	$t_{rr}$			-	753	1506	ns
Reverse Recovery Charge	$Q_{rr}$			-	14	28	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$			-	28	-	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 %  $V_{DSS}$ .

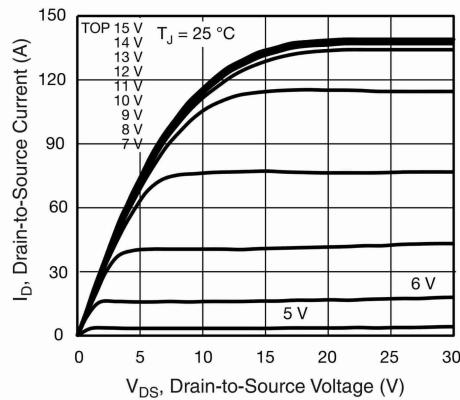
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)


Fig. 1 - Typical Output Characteristics

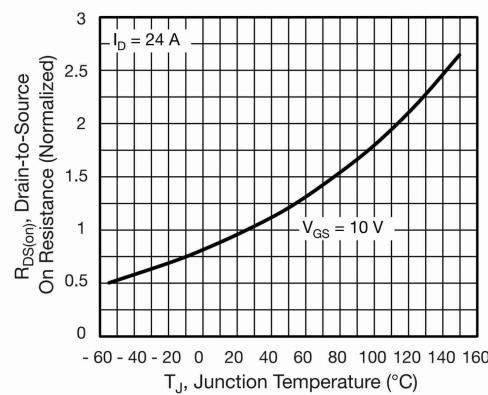


Fig. 4 - Normalized On-Resistance vs. Temperature

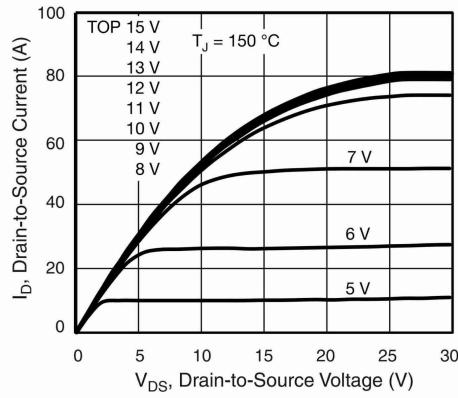


Fig. 2 - Typical Output Characteristics

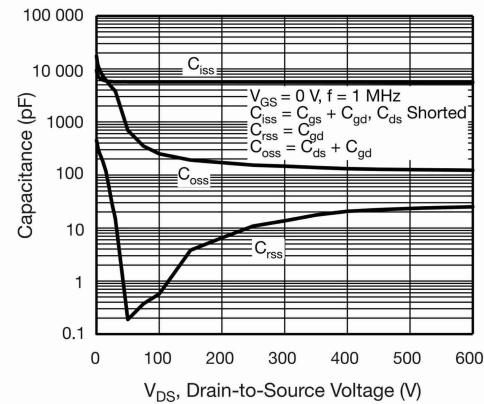


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

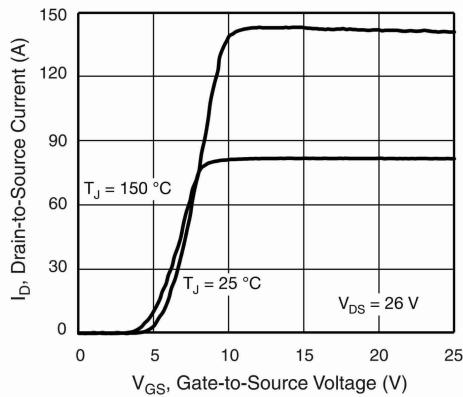
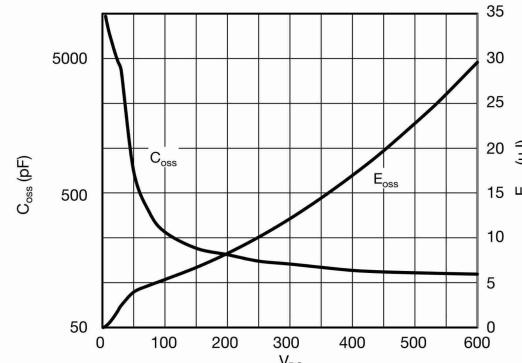


Fig. 3 - Typical Transfer Characteristics

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

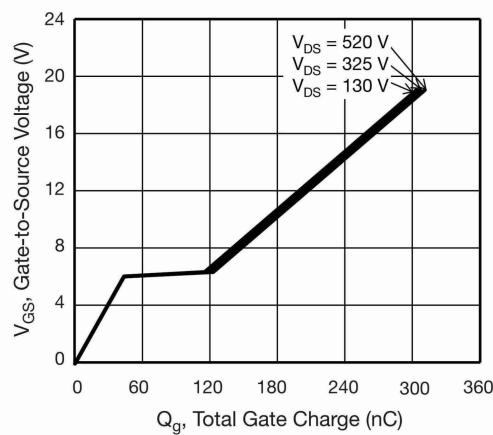


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

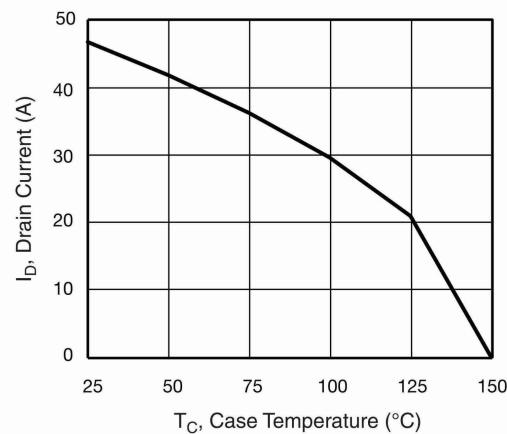


Fig. 10 - Maximum Drain Current vs. Case Temperature

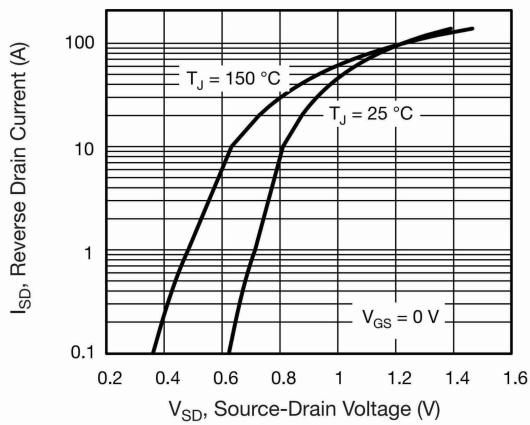


Fig. 8 - Typical Source-Drain Diode Forward Voltage

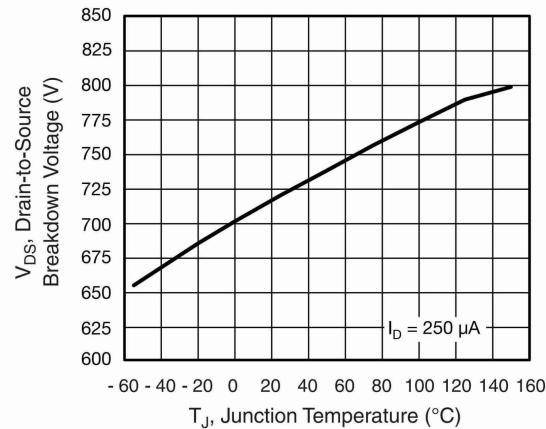


Fig. 11 - Temperature vs. Drain-to-Source Voltage

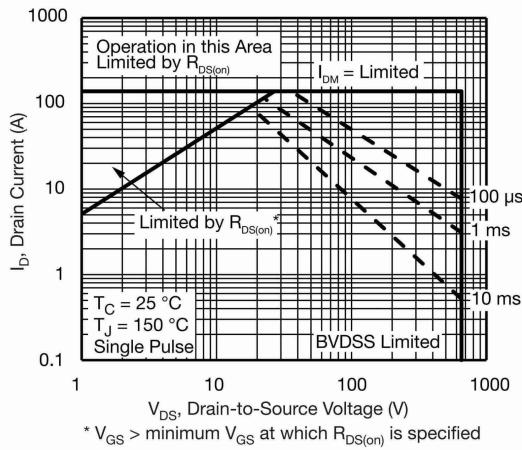


Fig. 9 - Maximum Safe Operating Area

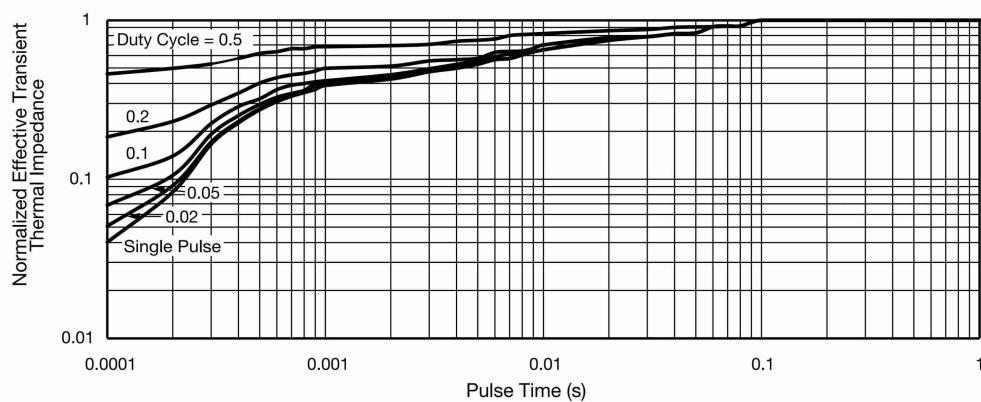


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

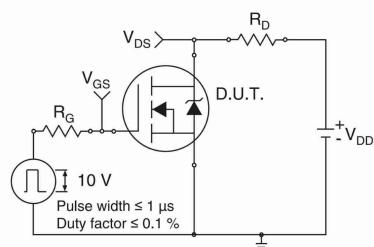


Fig. 13 - Switching Time Test Circuit

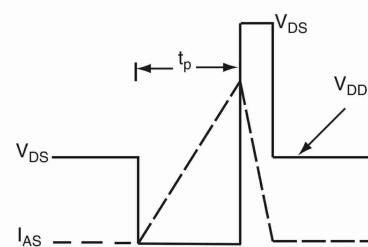


Fig. 16 - Unclamped Inductive Waveforms

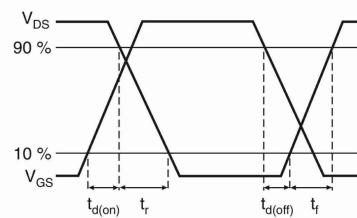


Fig. 14 - Switching Time Waveforms

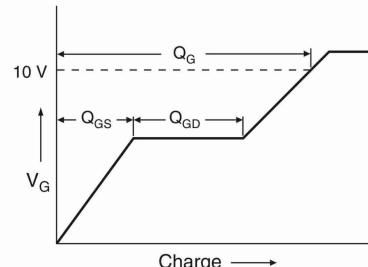


Fig. 17 - Basic Gate Charge Waveform

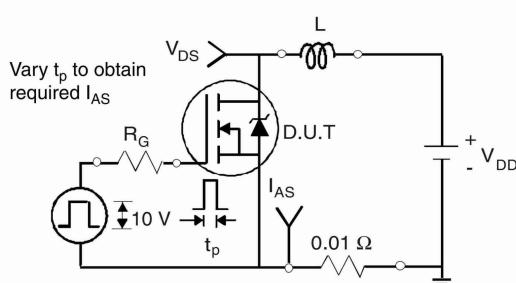


Fig. 15 - Unclamped Inductive Test Circuit

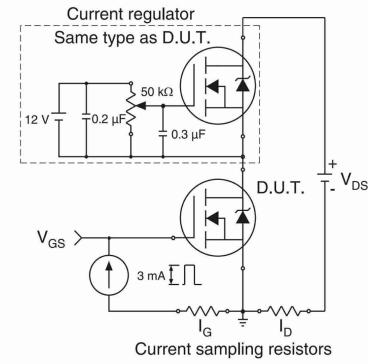
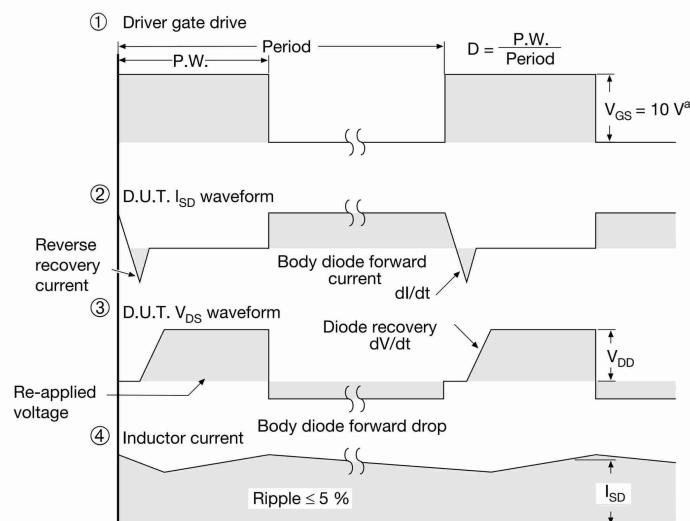
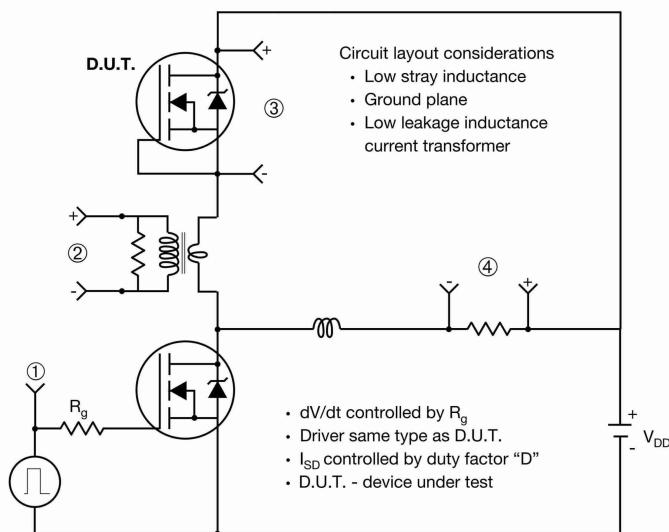
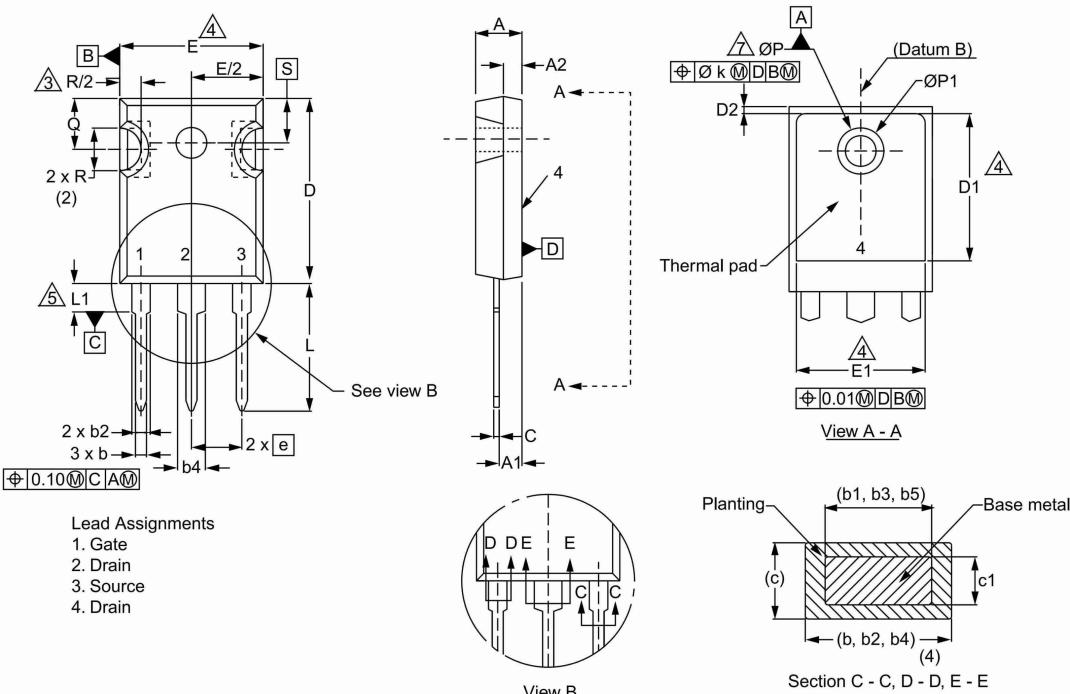


Fig. 18 - Gate Charge Test Circuit

**Peak Diode Recovery  $dV/dt$  Test Circuit**

**Fig. 19 - For N-Channel**

## TO-247AC (High Voltage)



DIM.	MILLIMETERS		INCHES	
	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	-

DIM.	MILLIMETERS		INCHES	
	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	
$\varnothing k$	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	
$\varnothing P$	3.51	3.66	0.138	0.144
$\varnothing P1$	-	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	

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