Normally-OFF Trench Silicon Carbide Power JFET

Product Summary		
BV_{DS}	1200	V
$R_{DS(ON)max}$	0.063	Ω
$E_{TS,typ}$	440	µJ

Features:
- Compatible with Standard Gate Driver ICs
- Positive Temperature Coefficient for Ease of Paralleling
- Temperature Independent Switching Behavior
- 175 ℃ Maximum Operating Temperature
- $R_{DS(on)max}$ of 0.063 Ω
- Voltage Controlled
- Low Gate Charge
- Low Intrinsic Capacitance

Applications:
- Solar Inverter
- SMPS
- Power Factor Correction
- Induction Heating
- UPS
- Motor Drive

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TO-247

3
2
1

D(2,4)

G(1)

S(3)
Internal Schematic
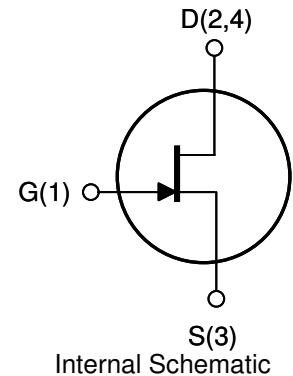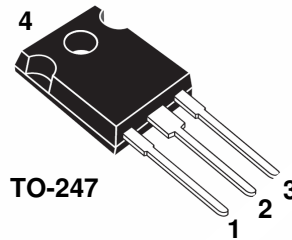
MAXIMUM RATINGS

Parameter	Symbol	Conditions	Value	Unit
Continuous Drain Current	$I_{D, Tj=125}$	T_j = 125 ℃	30	A
	$I_{D, Tj=175}$	T_j = 175 ℃	20	
Pulsed Drain Current [1]	I_{DM}	T_C = 25 ℃	60	A
Short Circuit Withstand Time	t_{SC}	V_{DD} < 800 V, T_C < 125 ℃	50	µs
Power Dissipation	P_D	T_C = 25 ℃	250	W
Gate-Source Voltage	V_{GS}	static	-15 to +3	V
		AC[2]	-15 to +15	V
Operating and Storage Temperature	T_j, $T_{j,stg}$		-55 to +175	℃
Lead Temperature for Soldering	T_{sold}	1/8" from case < 10 s	260	℃

[1] Limited by pulse width
[2] Rg_{EXT} = 0.5 ohm, $t_p \le$ 200ns

THERMAL CHARACTERISTICS

Parameter	Symbol	Value		Unit
		Typ	Max	
Thermal Resistance, junction-to-case	$R_{th,JC}$	-	0.6	℃ / W
Thermal Resistance, junction-to-ambient	$R_{th,JA}$	-	50	

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ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Value Min	Value Typ	Value Max	Unit

Off Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-Source Blocking Voltage	BV_{DS}	$V_{GS} = 0$ V, $I_D = 600$ µA	1200	-	-	V
Total Drain Leakage Current	I_{DSS}	$V_{DS} = 1200$ V, $V_{GS} = 0$ V, Tj = 25°C	-	200	1200	µA
		$V_{DS} = 1200$ V, $V_{GS} = 0$ V, Tj = 175°C	-	600	-	
		$V_{DS} = 1200$ V, $V_{GS} \leq -15$ V, Tj = 25°C	-	2	-	
		$V_{DS} = 1200$ V, $V_{GS} \leq -15$ V, Tj = 175°C	-	20	-	
Total Gate Reverse Leakage	I_{GSS}	$V_{GS} = -15$ V, VDS = 0V	-	-0.2	-0.6	mA
		$V_{GS} = -15$ V, VDS = 1200V	-	-0.2	-	

On Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-Source On-resistance	$R_{DS(on)}$	$I_D = 12$ A, $V_{GS} = 3$ V, $T_j = 25$ ℃	-	0.045	0.063	Ω
		$I_D = 12$ A, $V_{GS} = 3$ V, $T_j = 125$ ℃	-	0.11	-	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = 1$ V, $I_D = 34$ mA	0.75	1.00	1.25	V
Gate Forward Current	I_{GFWD}	$V_{GS} = 3$ V	-	400	-	mA
Gate Resistance	R_G	f = 1 MHz, drain-source shorted	-	4	-	Ω
	$R_{G(ON)}$	$V_{GS} > 2.7$V; See Figure 5	-	0.25	-	Ω

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Capacitance	C_{iss}	$V_{DD} = 100$ V	-	1220	-	pF
Output Capacitance	C_{oss}		-	180	-	
Reverse Transfer Capacitance	C_{rss}		-	169	-	
Effective Output Capacitance, energy related	$C_{o(er)}$	$V_{DS} = 0$ V to 480 V, $V_{GS} = 0$ V	-	100	-	

Switching Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Turn-on Delay	t_{on}	$V_{DS} = 600$ V, $I_D = 24$ A, Inductive Load, $T_J = 25$^{o}C Gate Driver = +15V, -10V, Rg$_{EXT}$ = 2.5ohm	-	15	-	ns
Rise Time	t_r		-	12	-	
Turn-off Delay	t_{off}		-	35	-	
Fall Time	t_f		-	30	-	
Turn-on Energy	E_{on}	See Figure 15 and application note for gate drive recommendations	-	160	-	uJ
Turn-off Energy	E_{off}		-	280	-	
Total Switching Energy	E_{ts}		-	440	-	
Turn-on Delay	t_{on}	$V_{DS} = 600$ V, $I_D = 24$ A, Inductive Load, $T_J = 150$^{o}C Gate Driver = +15V, -10V, Rg$_{EXT}$ = 2.5ohm	-	15	-	ns
Rise Time	t_r		-	15	-	
Turn-off Delay	t_{off}		-	35	-	
Fall Time	t_f		-	30	-	
Turn-on Energy	E_{on}	See Figure 15 and application note for gate drive recommendations	-	180	-	uJ
Turn-off Energy	E_{off}		-	280	-	
Total Switching Energy	E_{ts}		-	460	-	
Total Gate Charge	Q_g	$V_{DS} = 600$ V, $I_D = 10$ A, $V_{GS} = +2.5$ V	-	60	-	nC
Gate-Source Charge	Q_{gs}		-	2	-	
Gate-Drain Charge	Q_{gd}		-	49	-	

May 2009

Rev 1.3

Figure 1. Typical Output Characteristics

$I_D = f(V_{DS})$; $T_j = 25$ °C; parameter: V_{GS}

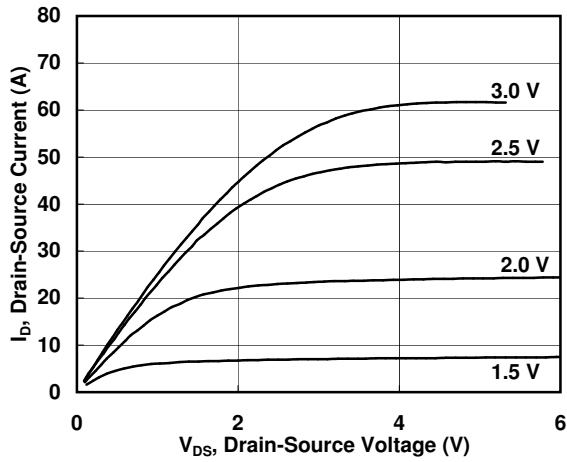**Figure 2. Typical Output Characteristics**
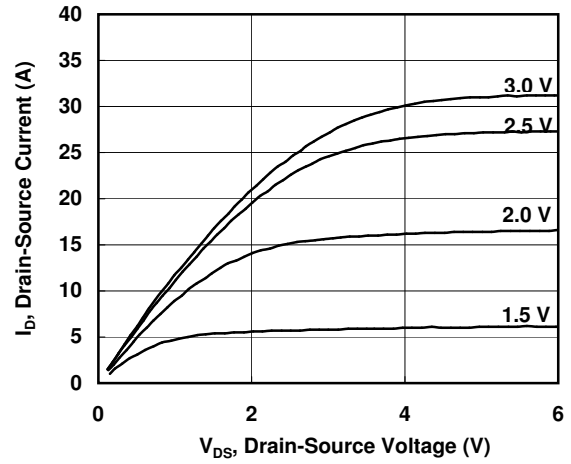
$I_D = f(V_{DS})$; $T_j = 125$ °C; parameter: V_{GS}

Figure 3. Typical Output Characteristics

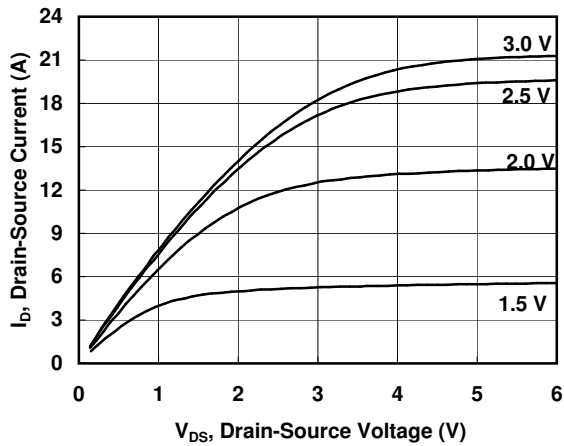$I_D = f(V_{DS})$; $T_j = 175$ °C; parameter: V_{GS}

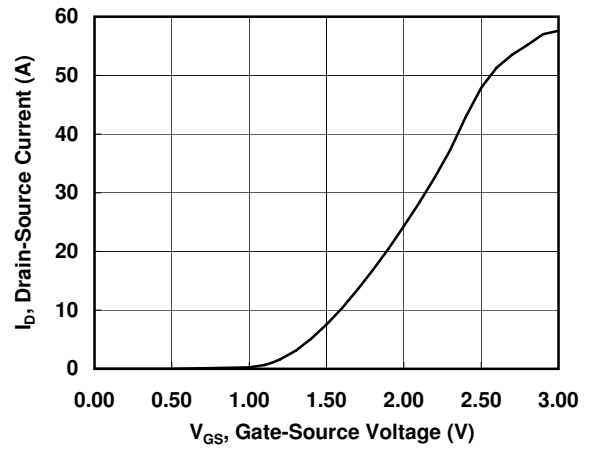**Figure 4. Typical Transfer Characteristics**

$I_D = f(V_{GS})$; $V_{DS} = 5$ V

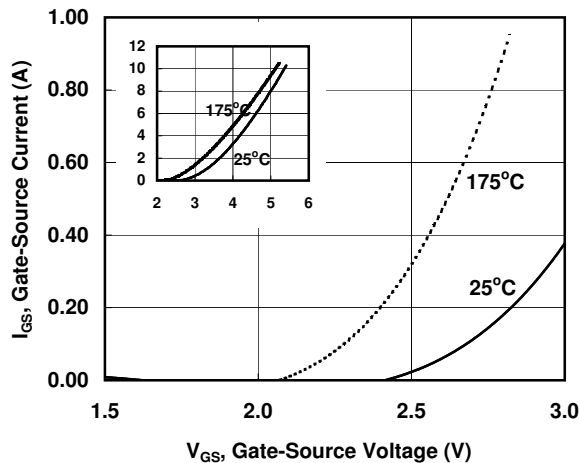**Figure 5. Gate-Source Current**

$I_{GS} = f(V_{GS})$; parameter: T_j

Figure 6. Drain-Source On-resistance

$R_{DS(on)} = f(I_D)$; $V_{GS} = 3.0$; parameter: Tj
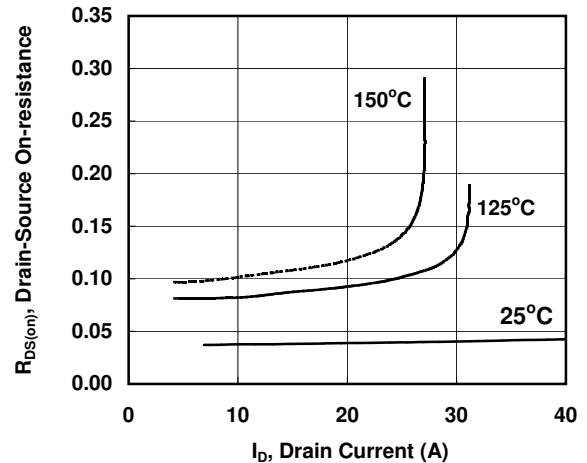
Figure 7. Drain-Source On-resistance

$R_{DS(ON)} = f(T_j)$; parameter: I_{GS}
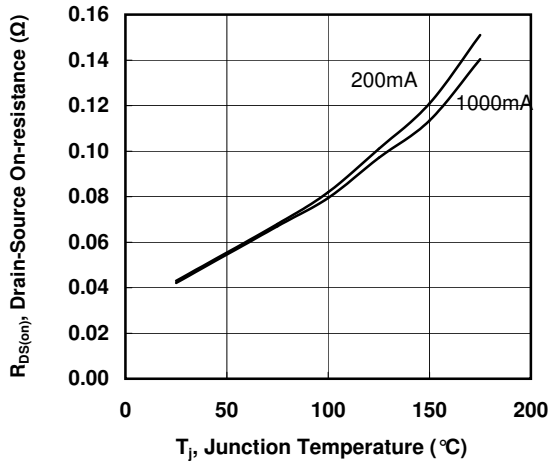
Figure 8. Drain-Source On-resistance

$R_{DS(ON)} = f(I_{GS})$; $T_j = 25^oC$
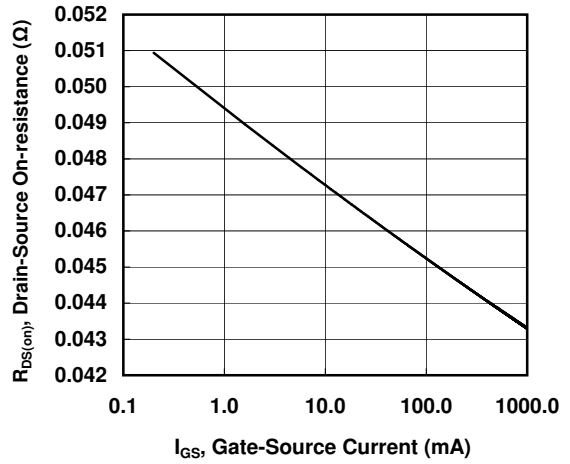
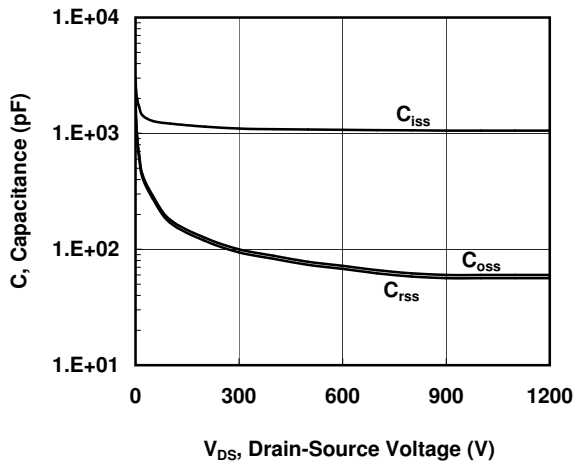**Figure 9. Typical Capacitance**

$C = f(V_{DS})$; $V_{GS} = 0$ V; f = 1 MHz

Figure 10. Gate Charge

$Q_g = f(V_{GS})$; $V_{DS} = 600V$; $I_D = 5A$, $T_j = 25^oC$
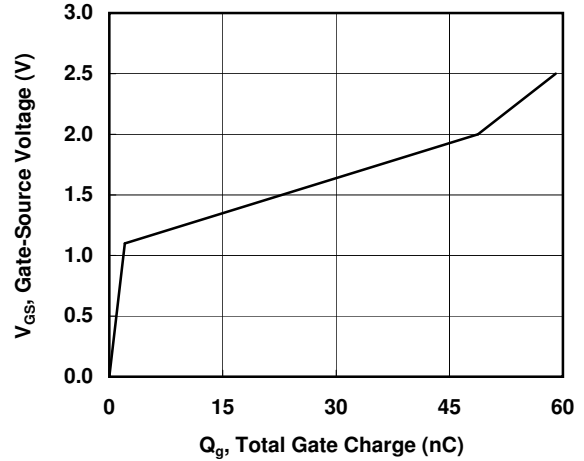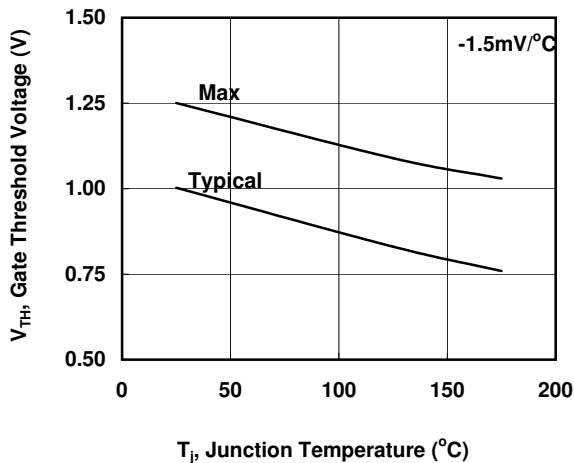

Figure 11. Gate Threshold Voltage

$V_{th} = f(T_j)$

Figure 12. Drain-Source Leakage
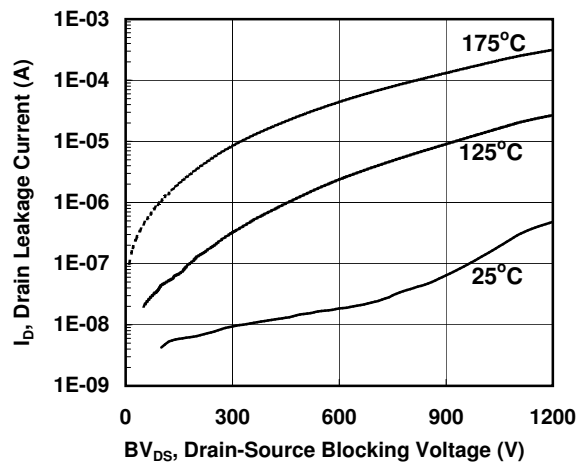
$I_D = f(V_{DS})$; $V_{GS} = 0V$; parameter: Tj

Figure 13. Switching Energy Losses
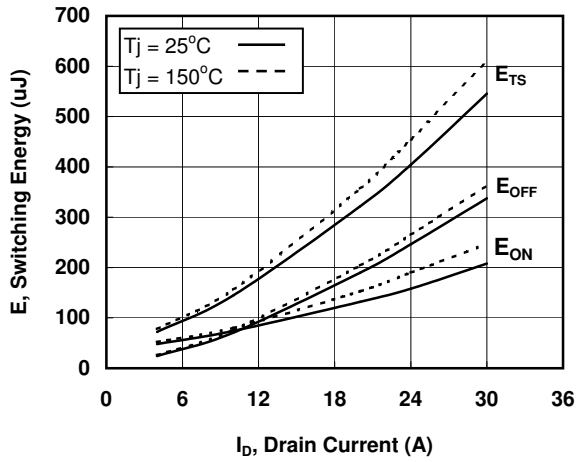$E_s = f(I_D)$; $V_{DS} = 600V$; GD = +15V/-10V, $R_{GEXT} = 2.5ohm$

Figure 14. Switching Energy Losses
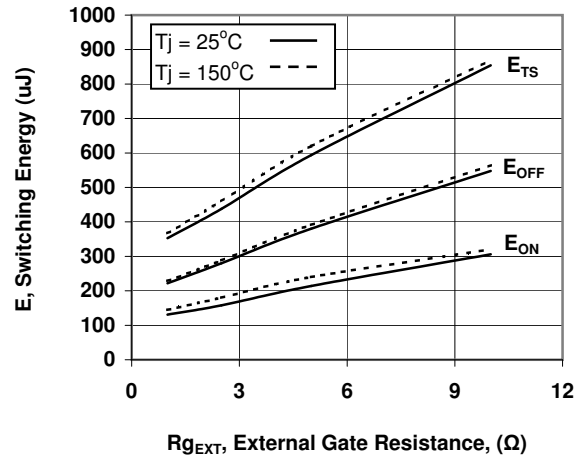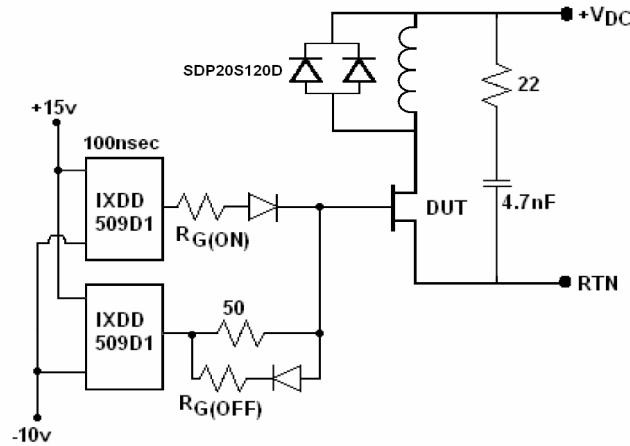$E_s = f(R_{GEXT})$; $V_{DS} = 600V$; $I_D = 24A$, GD = +15V/-10V

Figure 15. Inductive Load Switching Circuit
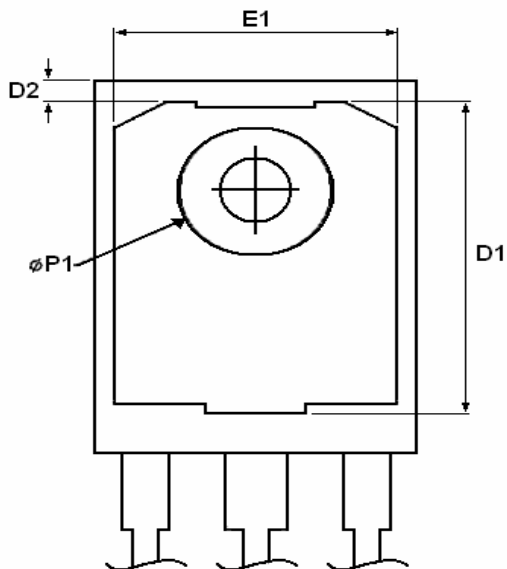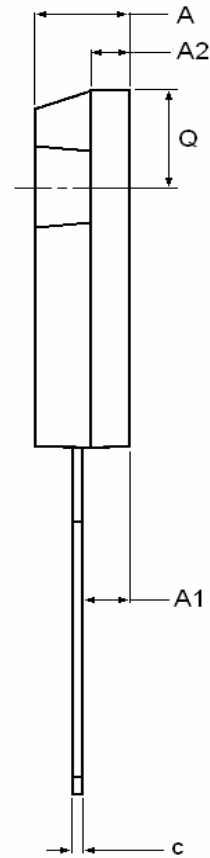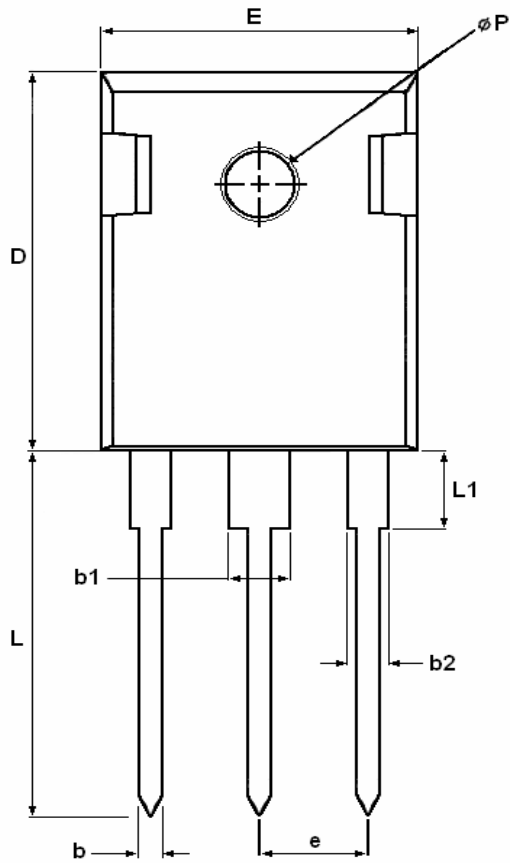
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.903	5.157	0.193	0.203
A1	2.273	2.527	0.090	0.100
A2	1.853	2.108	0.073	0.083
b	1.073	1.327	0.042	0.052
b1	2.873	3.381	0.113	0.133
b2	1.903	2.386	0.042	0.052
c	0.600	0.752	0.024	0.029
D	20.823	21.077	0.820	0.830
D1	17.393	17.647	0.685	0.695
D2	1.063	1.317	0.042	0.052
e	5.450		0.215	
E	15.773	16.027	0.621	0.631
E1	13.893	14.147	0.547	0.557
L	20.053	20.307	0.789	0.799
L1	4.168	4.472	0.165	0.175
Q	6.043	6.297	0.238	0.248
ØP	7.823	8.077	0.308	0.318
ØP1	7.063	7.317	0.278	0.288

Published by
SemiSouth Laboratories, Inc.
201 Research Boulevard
Starkville, MS 39759 USA
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