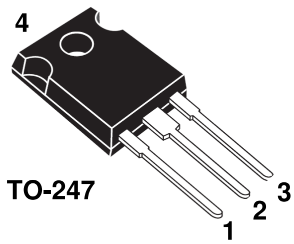
Normally-OFF Trench Silicon Carbide Power JFET

Product Summary		
BV_{DS}	1700	V
$R_{DS(ON)max}$	0.550	Ω
$E_{TS,typ}$	74	µJ

Features:

- Compatible with Standard Gate Driver ICs
- Positive Temperature Coefficient for Ease of Paralleling
- Temperature Independent Switching Behavior
- 175 °C Maximum Operating Temperature
- $R_{DS(on)max}$ of 0.550 Ω
- Voltage Controlled
- Low Gate Charge
- Low Intrinsic Capacitance



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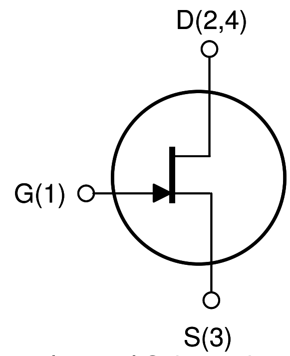


Internal Schematic

Applications:

- Flyback Auxillary Power Supplies for:
  - Solar inverters
  - Motor Drives
  - High Voltage SMPS
  - High Voltage UPS

MAXIMUM RATINGS

Parameter	Symbol	Conditions	Value	Unit
Continuous Drain Current	$I_{D, Tj=125}$	T_j = 125 °C	4	A
	$I_{D, Tj=175}$	T_j = 175 °C	3	
Pulsed Drain Current [(1)]	I_{DM}	T_C = 25 °C	8	A
Short Circuit Withstand Time	t_{SC}	V_{DD} < 800 V, T_C < 125 °C	TBD	µs
Power Dissipation	P_D	T_C = 25 °C	58	W
Gate-Source Voltage	V_{GS}	AC[(2)]	-15 to +15	V
Operating and Storage Temperature	T_j, $T_{j,stg}$		-55 to +175	°C
Lead Temperature for Soldering	T_{sold}	1/8" from case < 10 s	260	°C

(1) Limited by pulse width
(2) Rg_{EXT} = 1 ohm, $t_p \leq$ 200ns, see Figure 5 for static conditions

THERMAL CHARACTERISTICS

Parameter	Symbol	Value		Unit
		Typ	Max	
Thermal Resistance, junction-to-case	$R_{th,JC}$	-	2.6	°C / W
Thermal Resistance, junction-to-ambient	$R_{th,JA}$	-	50	

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Off Characteristics						
Drain-Source Blocking Voltage	BV_{DS}	V_{GS} = 0 V, I_D = 200 μA	1700	-	-	V
Total Drain Leakage Current	I_{DSS}	V_{DS} = 1700 V, V_{GS} = 0 V, Tj = 25°C	-	10	200	μA
		V_{DS} = 1700 V, V_{GS} = 0 V, Tj = 175°C	-	50	-	
		V_{DS} = 1700 V, $V_{GS} \leq$ -15 V, Tj = 25°C	-	10	-	
		V_{DS} = 1700 V, $V_{GS} \leq$ -15 V, Tj = 175°C	-	30	-	
Total Gate Reverse Leakage	I_{GSS}	V_{GS} = -15 V, VDS = 0V	-	-0.02	-0.1	mA
		V_{GS} = -15 V, VDS = 1700V	-	-0.02	-	
On Characteristics						
Drain-Source On-resistance	$R_{DS(on)}$	I_D = 3 A, V_{GS} = 3 V, T_j = 25 °C	-	0.45	0.55	Ω
		I_D = 3 A, V_{GS} = 3 V, T_j = 125 °C	-	1.08	-	
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = 1 V, I_D = 10 mA	0.75	1.00	1.25	V
Gate Forward Current	I_{GFWD}	V_{GS} = 3 V	-	135	-	mA
Gate Resistance	R_G	f = 1 MHz, drain-source shorted	-	15	-	Ω
	$R_{G(ON)}$	V_{GS} >2.7V; See Figure 5	-	1	-	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{DD} = 300 V	-	170	-	pF
Output Capacitance	C_{oss}		-	20	-	
Reverse Transfer Capacitance	C_{rss}		-	17	-	
Effective Output Capacitance, energy related	$C_{o(er)}$	V_{DS} = 0 V to 600 V, V_{GS} = 0 V	-	20	-	
Switching Characteristics						
Turn-on Delay	t_{on}	V_{DS} = 850 V, I_D = 3 A, Inductive Load, T_J = 25°C Gate Driver = +15V unipolar Rg_{EXT} = 20ohm See Figure 14 and application note for gate drive recommendations	-	12	-	ns
Rise Time	t_r		-	14	-	
Turn-off Delay	t_{off}		-	28	-	
Fall Time	t_f		-	30	-	
Turn-on Energy	E_{on}		-	41	-	μJ
Turn-off Energy	E_{off}		-	33	-	
Total Switching Energy	E_{ts}		-	74	-	
Turn-on Delay	t_{on}	V_{DS} = 850 V, I_D = 3 A, Inductive Load, T_J = 150°C Gate Driver = +15V unipolar Rg_{EXT} = 20ohm See Figure 14 and application note for gate drive recommendations	-	TBD	-	ns
Rise Time	t_r		-	TBD	-	
Turn-off Delay	t_{off}		-	TBD	-	
Fall Time	t_f		-	TBD	-	
Turn-on Energy	E_{on}		-	TBD	-	μJ
Turn-off Energy	E_{off}		-	TBD	-	
Total Switching Energy	E_{ts}		-	TBD	-	
Total Gate Charge	Q_g	V_{DS} = 850 V, I_D = 1.5 A, V_{GS} = + 2.5 V	-	10	-	nC
Gate-Source Charge	Q_{gs}		-	8	-	
Gate-Drain Charge	Q_{gd}		-	1	-	

Figure 1. Typical Output Characteristics

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

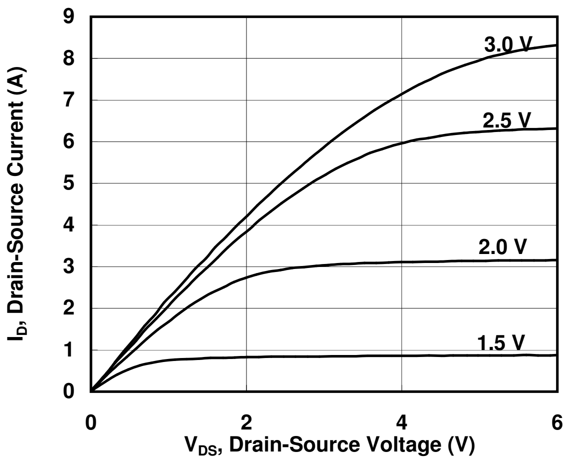


Figure 2. Typical Output Characteristics

$I_D = f(V_{DS})$; T_j = 125 °C; parameter: V_{GS}

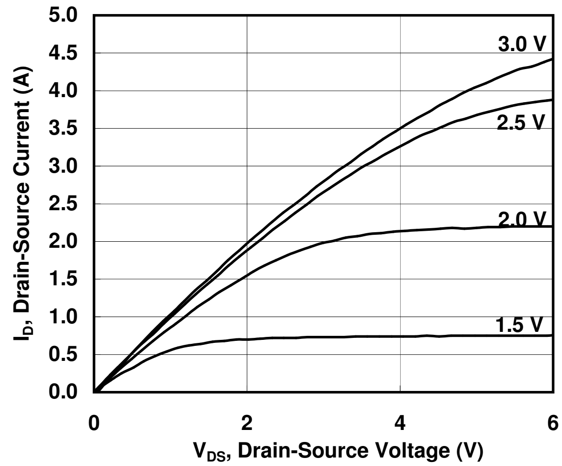


Figure 3. Typical Output Characteristics

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

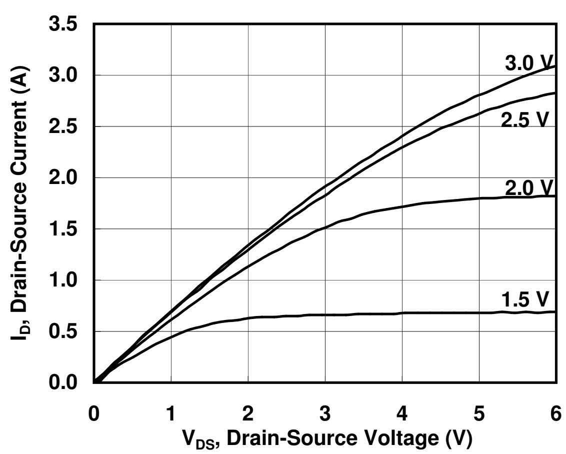


Figure 4. Typical Transfer Characteristics

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

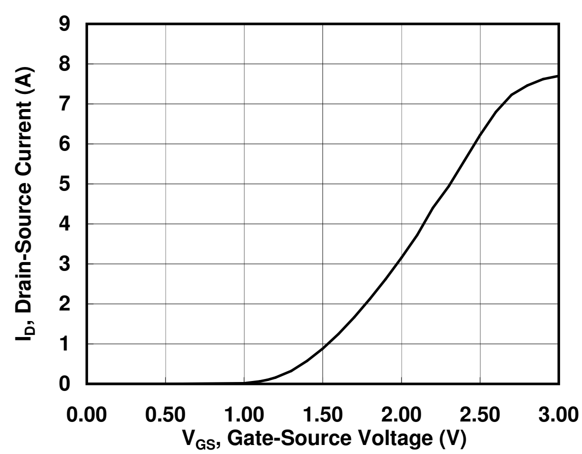


Figure 5. Gate-Source Current

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

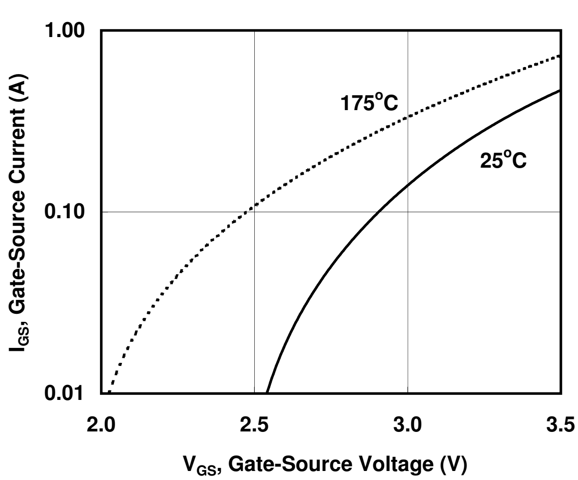


Figure 6. Drain-Source On-resistance

$R_{DS(on)} = f(I_D)$; V_{GS} = 3.0; parameter: Tj

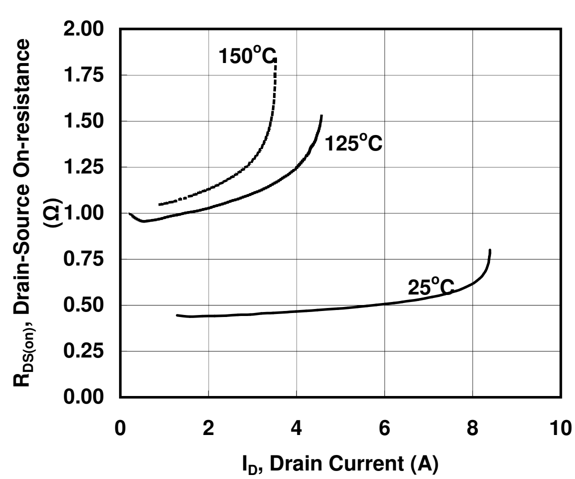


Figure 7. Drain-Source On-resistance

$R_{DS(ON)} = f(T_j)$; parameter: I_{GS}

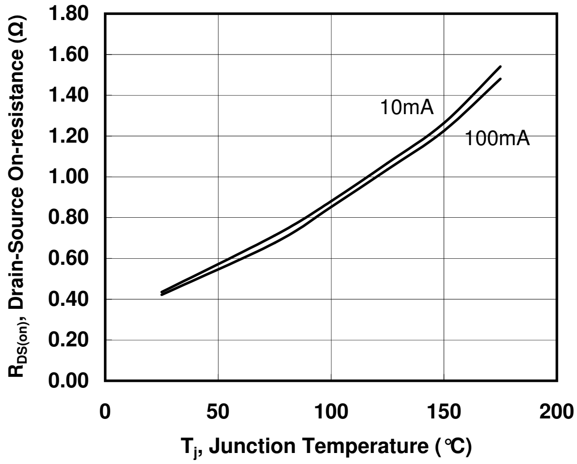


Figure 8. Drain-Source On-resistance

$R_{DS(ON)} = f(I_{GS})$; $T_j = 25^oC$

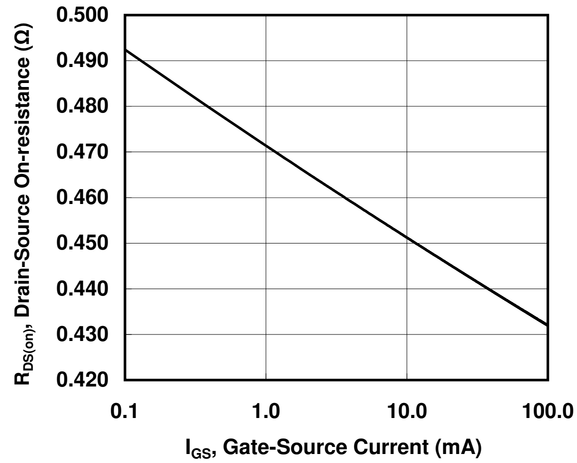


Figure 9. Typical Capacitance

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

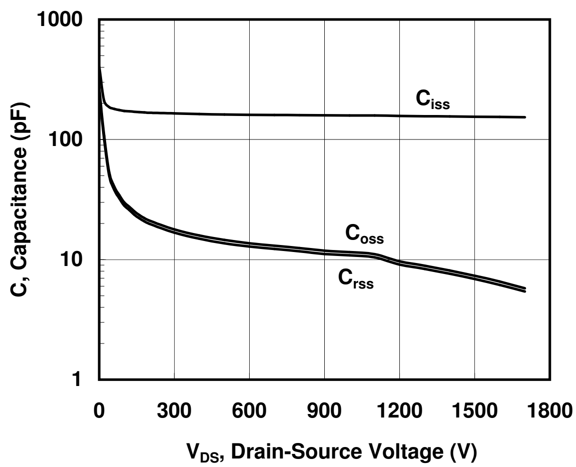


Figure 10. Gate Charge

$Q_g = f(V_{GS})$; $V_{DS} = 850V$; $I_D = 1.5A$, $T_j = 25^oC$

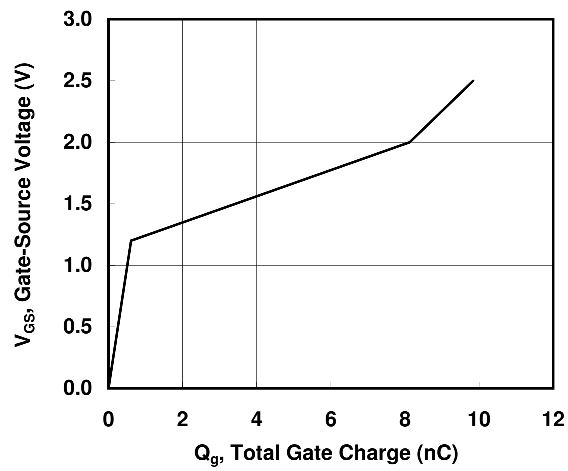


Figure 11. Gate Threshold Voltage

$V_{th} = f(T_j)$, normalized

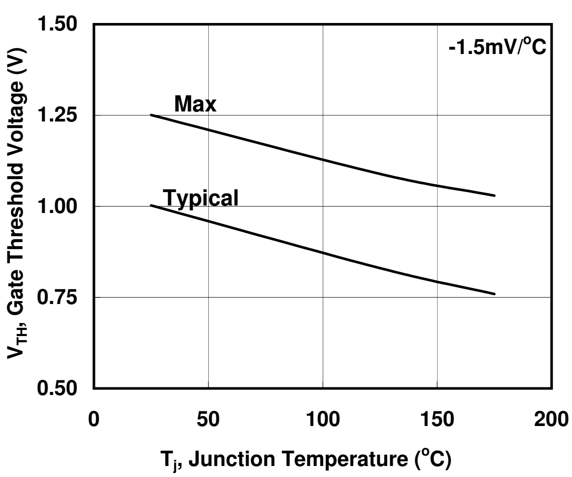


Figure 12. Drain-Source Leakage

$I_D = f(V_{DS})$; $V_{GS} = 0V$; parameter: Tj

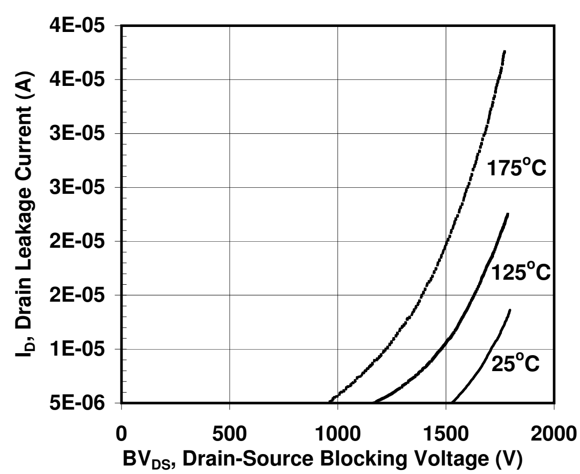


Figure 13. Switching Energy Losses

$E_s = f(I_D)$; V_{DS} = 850V; GD = +15V, R_{GEXT} = 20ohm; Tc = 25°C

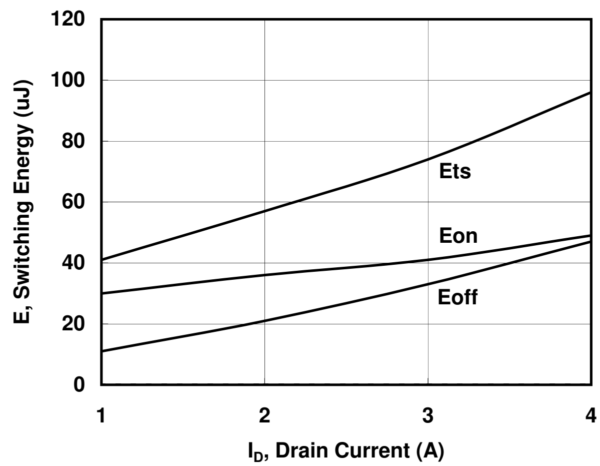
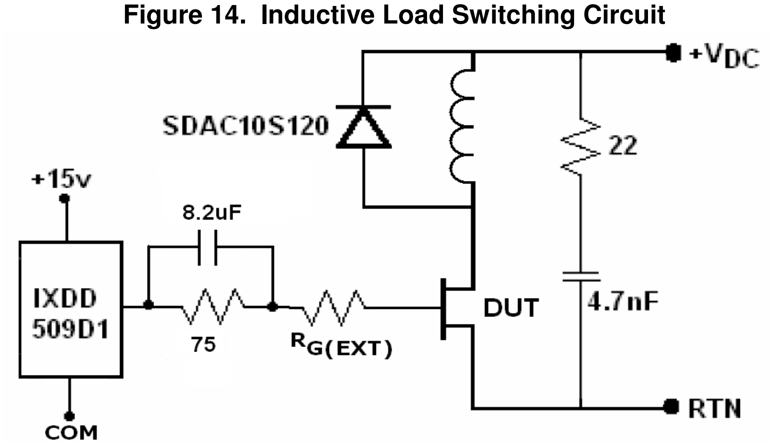
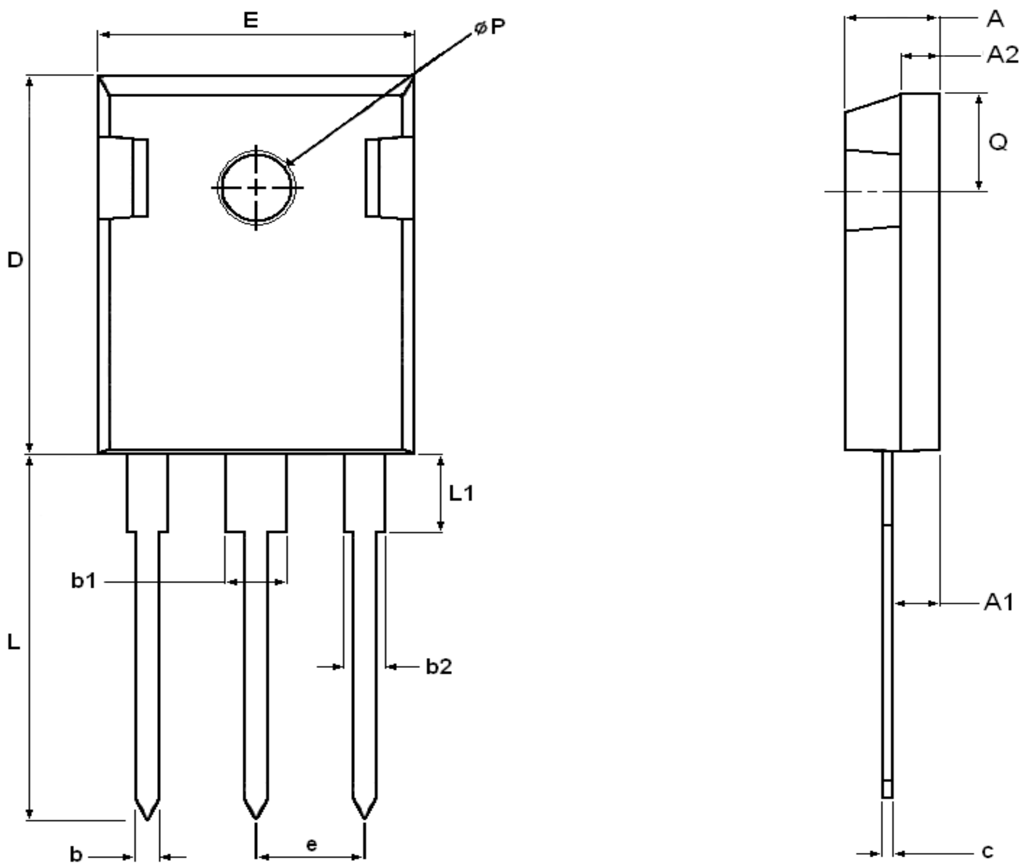
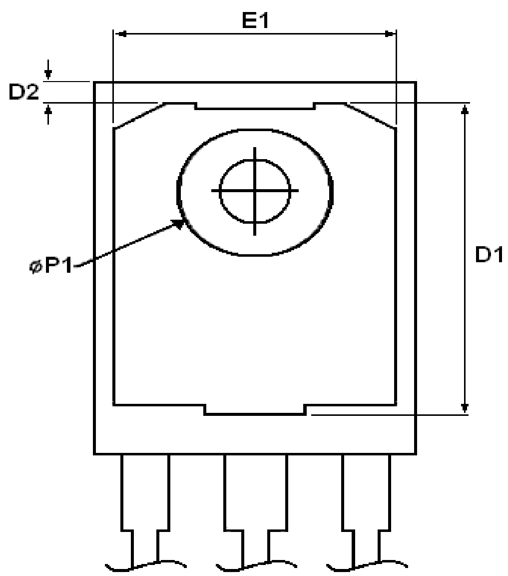


Figure 14. Inductive Load Switching Circuit







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	3.560	3.660	0.140	0.144
ØP1	7.063	7.317	0.278	0.288

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