

## P-Channel 60-V (D-S) MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 60	0.066 at $V_{GS} = - 10$ V	- 20	40 nC
	0.080 at $V_{GS} = - 4.5$ V	- 18	

### FEATURES

- Trench Power MOSFET
- 100 % UIS Tested

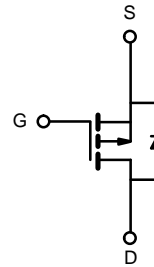
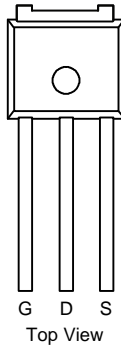
### APPLICATIONS

- Load Switch



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

TO-251



P-Channel MOSFET

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		$V_{DS}$	- 60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	- 20 <sup>a</sup>	A
	$T_C = 70$ °C		- 16	
	$T_A = 25$ °C		- 11 <sup>b</sup>	
	$T_A = 70$ °C		- 9 <sup>b</sup>	
Pulsed Drain Current		$I_{DM}$	- 100	
Avalanche Current Pulse		$I_{AS}$	- 35	mJ
Single Pulse Avalanche Energy		$E_{AS}$	101	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	$I_S$	- 29 <sup>a</sup>	A
	$T_A = 25$ °C		- 2.1 <sup>b</sup>	
Maximum Power Dissipation	$T_C = 25$ °C	$P_D$	35 <sup>a</sup>	W
	$T_C = 70$ °C		20 <sup>a</sup>	
	$T_A = 25$ °C		3.0 <sup>b</sup>	
	$T_A = 70$ °C		2 <sup>b</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 150	°C

### THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b</sup>	Steady State	$R_{thJA}$	33	40	°C/W
	Steady State	$R_{thJC}$	0.98	1.2	

Notes:

a. Based on  $T_C = 25$  °C.

b. Surface mounted on 1" x 1" FR4 board.

SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA	- 60			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = - 250 μA		68		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 5.2		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA	- 1.0		- 2.5	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V			- 1	μA
		V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			- 10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = - 5 V, V <sub>GS</sub> = - 10 V	- 120			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 30 A		0.066		Ω
		V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 20 A		0.080		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 50 A	20			S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = - 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1200		pF
Output Capacitance	C <sub>oss</sub>			200		
Reverse Transfer Capacitance	C <sub>rss</sub>			150		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 55 A		40		nC
		V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 55 A		38		
Gate-Source Charge	Q <sub>gs</sub>			16		
Gate-Drain Charge	Q <sub>gd</sub>			19		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		5.2		Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = - 2 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ - 10 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω		10	15	ns
Rise Time	t <sub>r</sub>			7	15	
Turn-Off Delay Time	t <sub>d(off)</sub>			70	110	
Fall Time	t <sub>f</sub>			40	60	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 66	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				- 150	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 30 A		- 1	- 1.5	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = - 50 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C		45	68	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			59	120	nC
Reverse Recovery Fall Time	t <sub>a</sub>			29		ns
Reverse Recovery Rise Time	t <sub>b</sub>			16		

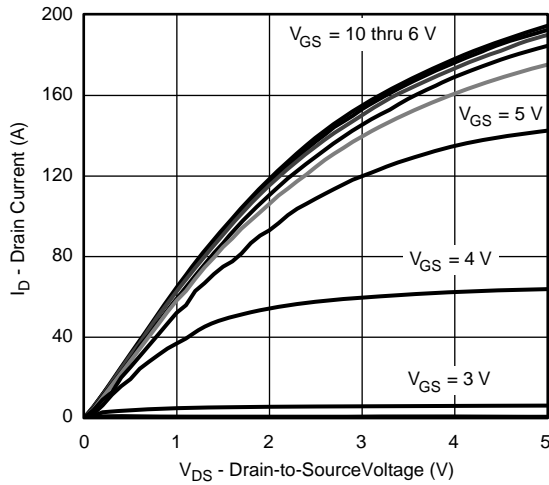
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

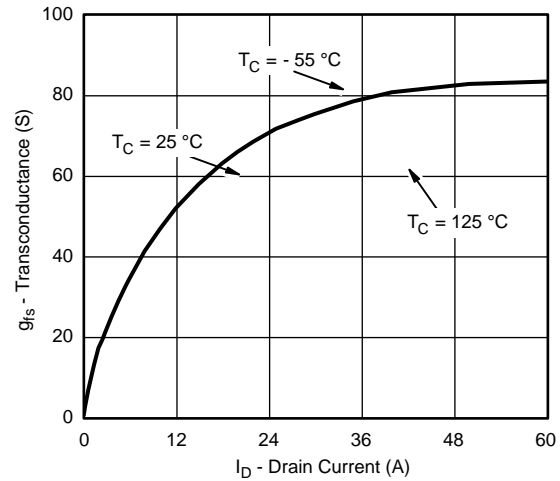
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

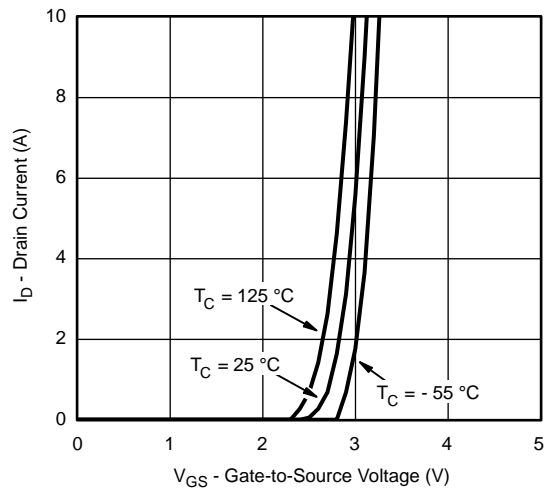
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



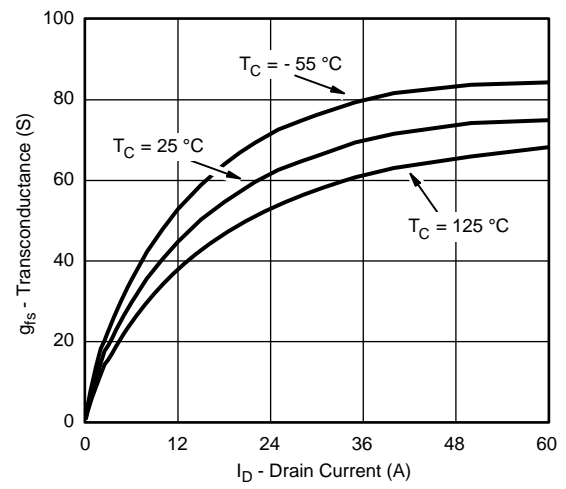
**Output Characteristics**



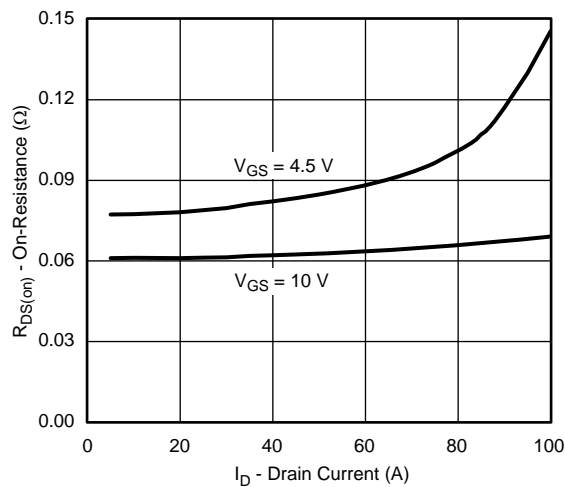
**Transconductance**



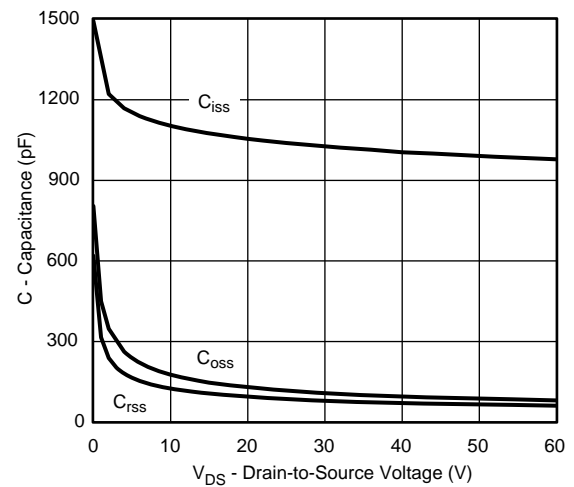
**Transfer Characteristics**



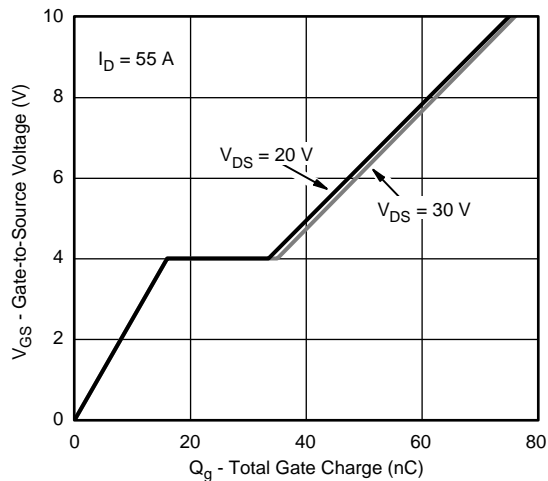
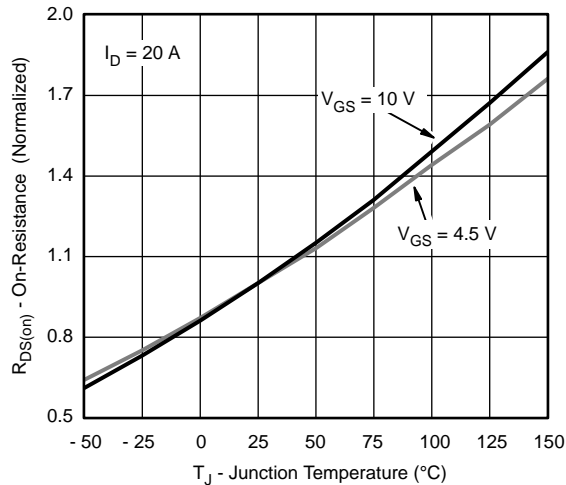
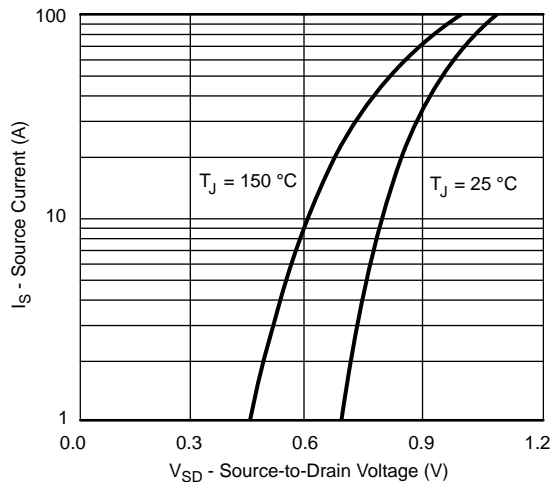
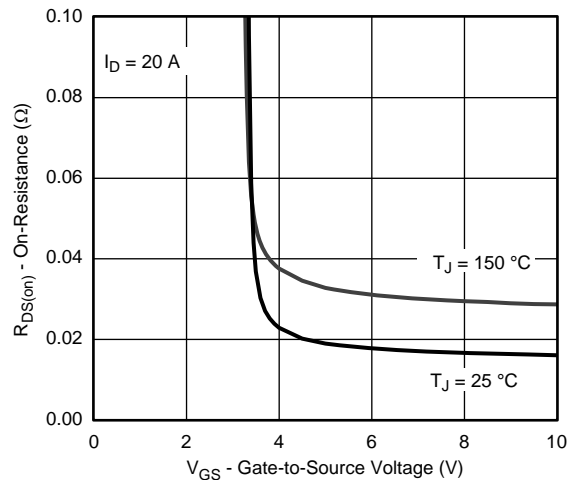
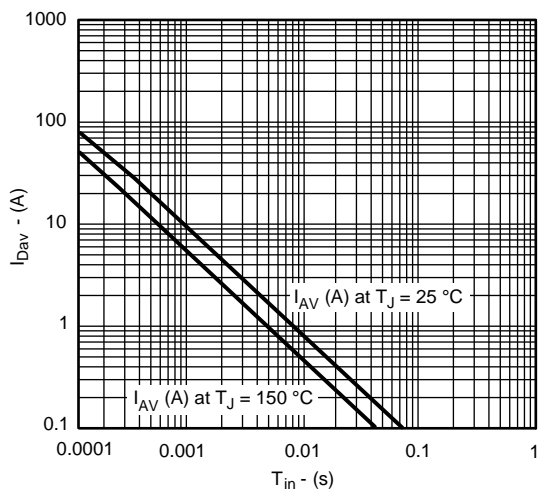
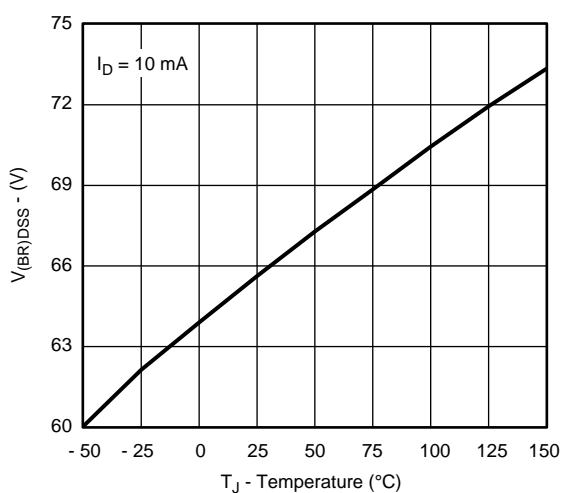
**Transconductance**



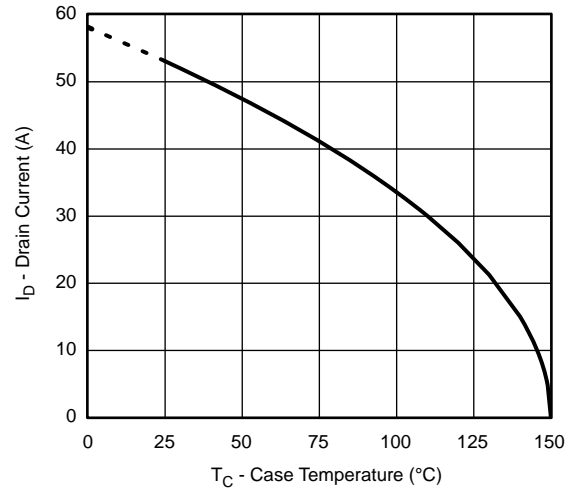
**On-Resistance vs. Drain Current**

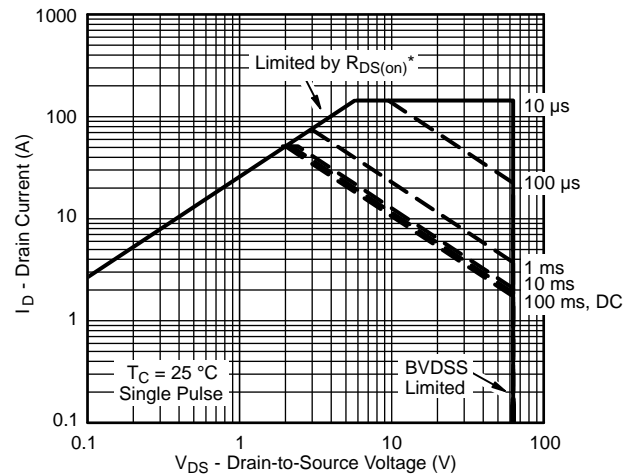


**Capacitance**

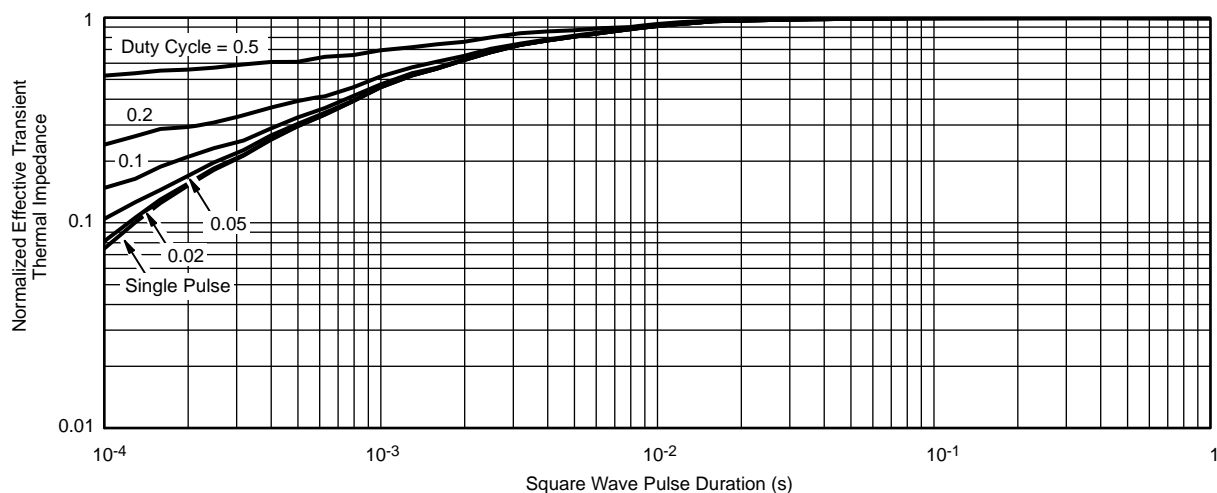
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Gate Charge**

**On-Resistance vs. Gate-to-Source Voltage**

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-to-Source Voltage**

**Single Pulse Avalanche Current Capability vs. Time**

**Drain-Source Breakdown Voltage vs. Junction Temperature**

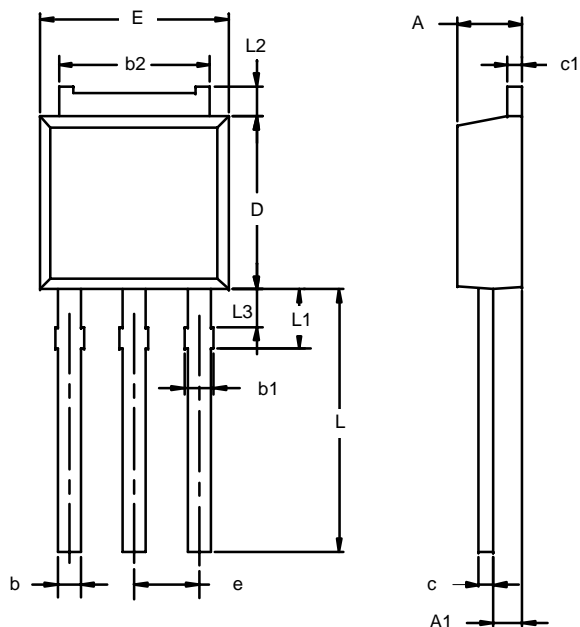
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Threshold Voltage**

**Max. Drain Current vs. Case Temperature**

**Power Derating, Junction-to-Case**


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

**Safe Operating Area, Junction-to-Case**

**Normalized Thermal Transient Impedance, Junction-to-Case**

**TO-251AA (DPAK)**

Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
<b>A</b>	2.21	2.38	0.087	0.094
<b>A1</b>	0.89	1.14	0.035	0.045
<b>b</b>	0.71	0.89	0.028	0.035
<b>b1</b>	0.76	1.14	0.030	0.045
<b>b2</b>	5.23	5.43	0.206	0.214
<b>c</b>	0.46	0.58	0.018	0.023
<b>c1</b>	0.46	0.58	0.018	0.023
<b>D</b>	5.97	6.22	0.235	0.245
<b>E</b>	6.48	6.73	0.255	0.265
<b>e</b>	2.28 BSC		0.090 BSC	
<b>L</b>	8.89	9.53	0.350	0.375
<b>L1</b>	1.91	2.28	0.075	0.090
<b>L2</b>	0.89	1.27	0.035	0.050
<b>L3</b>	1.15	1.52	0.045	0.060
ECN: S-03946—Rev. E, 09-Jul-01 DWG: 5346				

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