

# AP9578S-VB Datasheet

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

### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ)
- 60	0.064 at $V_{GS} = - 10$ V	- 30	12
	0.077 at $V_{GS} = - 4.5$ V	- 28	

### FEATURES

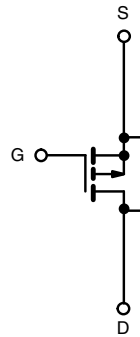
- Trench Power MOSFET 100
- % UIS Tested

### APPLICATIONS

- Load Switch



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



P-Channel MOSFET

### ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted

Parameter		Symbol	Limit	Unit
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_J = 175\text{ }^\circ\text{C}$ )	$T_C = 25\text{ }^\circ\text{C}$	$I_D$	- 30	A
	$T_C = 100\text{ }^\circ\text{C}$		- 20	
Pulsed Drain Current		$I_{DM}$	- 90	
Continuing Source Current (Diode Conduction)		$I_S$	- 28	
Avalanche Current		$I_{AS}$	- 31	
Single Pulse Avalanche Energy	$L = 0.1\text{ mH}$	$E_{AS}$	7.2	mJ
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	$P_D$	60 <sup>a</sup>	W
	$T_A = 25\text{ }^\circ\text{C}$		6 <sup>b</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 175	$^\circ\text{C}$

### THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Junction-to-Ambient <sup>b</sup>	$t \leq 10\text{ sec}$	$R_{thJA}$	20	25	$^\circ\text{C/W}$
	Steady State		62	75	
Junction-to-Case		$R_{thJC}$	5	6	

Notes:

a. See SOA curve for voltage derating.

b. Surface Mounted on 1" x 1" FR-4 board.

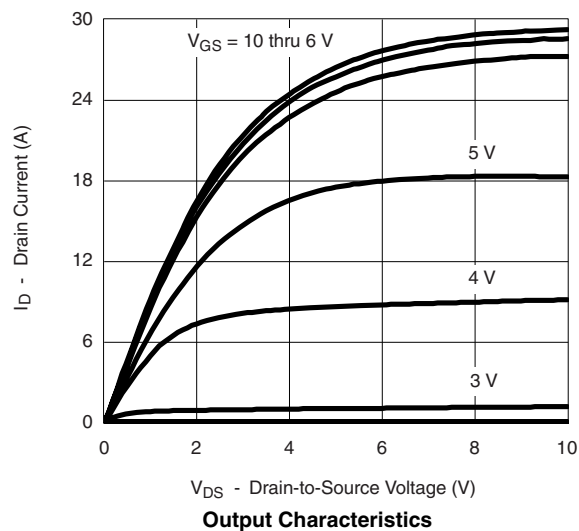
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min	Typ <sup>a</sup>	Max	Unit
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	- 60			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	- 1.0	- 2.0	- 3.0	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$			- 50	
		$V_{DS} = -60\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 175\text{ }^{\circ}\text{C}$			- 150	
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} = -5\text{ V}$ , $V_{GS} = -10\text{ V}$	- 10			A
Drain-Source On-State Resistance <sup>b</sup>	$r_{DS(on)}$	$V_{GS} = -10\text{ V}$ , $I_D = -5\text{ A}$		0.064		$\Omega$
		$V_{GS} = -10\text{ V}$ , $I_D = -5\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		0.110		
		$V_{GS} = -10\text{ V}$ , $I_D = -5\text{ A}$ , $T_J = 175\text{ }^{\circ}\text{C}$		0.250		
		$V_{GS} = -4.5\text{ V}$ , $I_D = -2\text{ A}$		0.077		
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}$ , $I_D = -5\text{ A}$		8		S
Dynamic						
Input Capacitance	$C_{iss}$	$V_{DS} = -25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		1000		pF
Output Capacitance	$C_{oss}$			210		
Reverse Transfer Capacitance	$C_{rss}$			110		
Total Gate Charge	$Q_g$	$V_{DS} = -30\text{ V}$ , $V_{GS} = -10\text{ V}$ , $I_D = -8.4\text{ A}$		12.5	19	nC
Gate-Source Charge	$Q_{gs}$			2.3		
Gate-Drain Charge	$Q_{gd}$			3.2		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		8.0		$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = -30\text{ V}$ , $R_L = 3.57\text{ }\Omega$ $I_D \cong -8.4\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_G = 2.5\text{ }\Omega$		5	10	ns
Rise Time <sup>c</sup>	$t_r$			14	25	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			15	25	
Fall Time <sup>c</sup>	$t_f$			7	12	
Source-Drain Diode Ratings and Characteristics ( $T_C = 25\text{ }^{\circ}\text{C}$ ) <sup>b</sup>						
Pulsed Current	$I_{SM}$				- 30	A
Forward Voltage <sup>b</sup>	$V_{SD}$	$I_F = -2\text{ A}$ , $V_{GS} = 0\text{ V}$		- 0.9	- 1.3	V
Reverse Recovery Time	$t_{rr}$	$I_F = -8\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		50	80	ns
Reverse Recovery Time	$Q_{rr}$			80	120	nC

Notes:

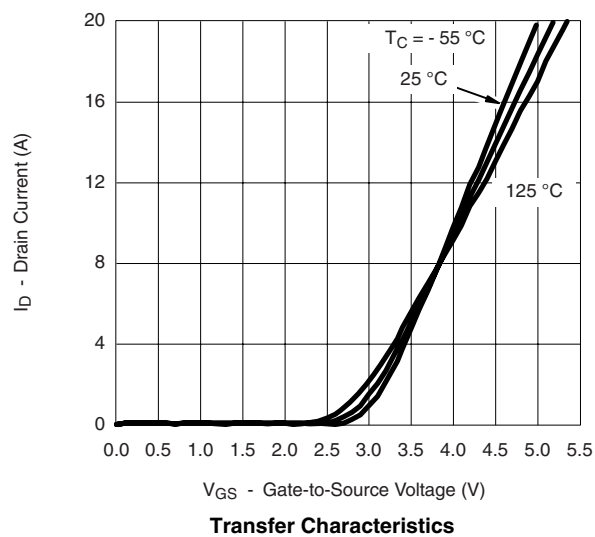
- a. Guaranteed by design, not subject to production testing.  
 b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 c. Independent of operating temperature.

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.

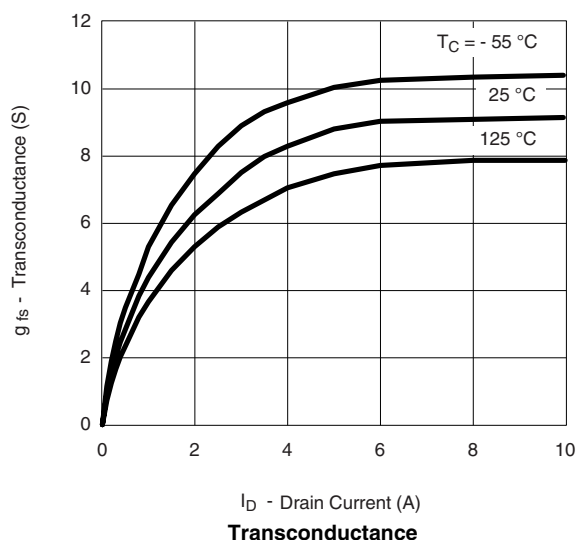
**TYPICAL CHARACTERISTICS** 25 °C unless noted



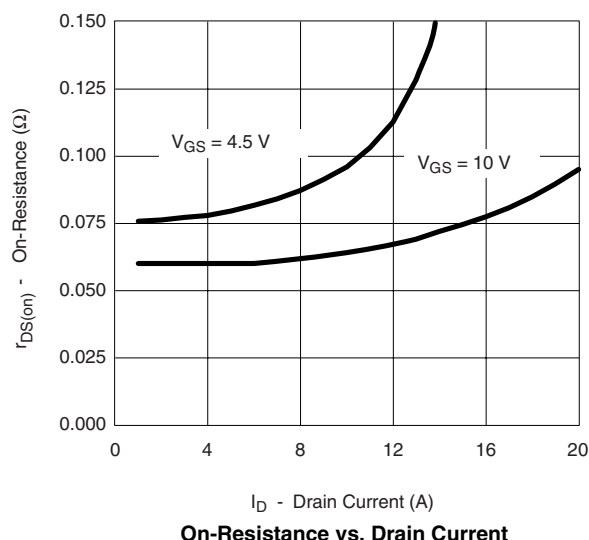
**Output Characteristics**



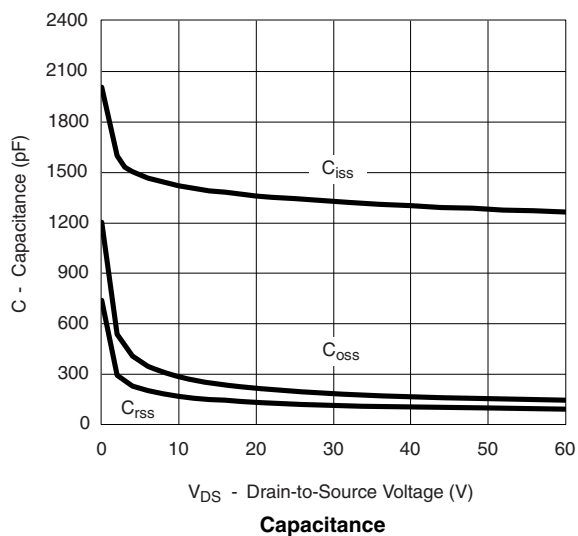
**Transfer Characteristics**



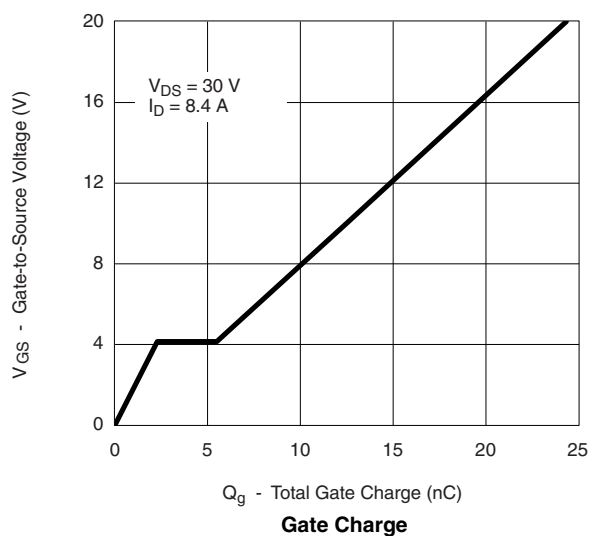
**Transconductance**



**On-Resistance vs. Drain Current**

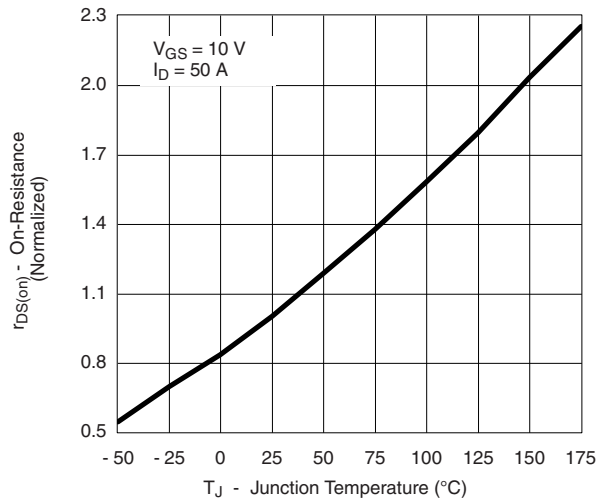


**Capacitance**

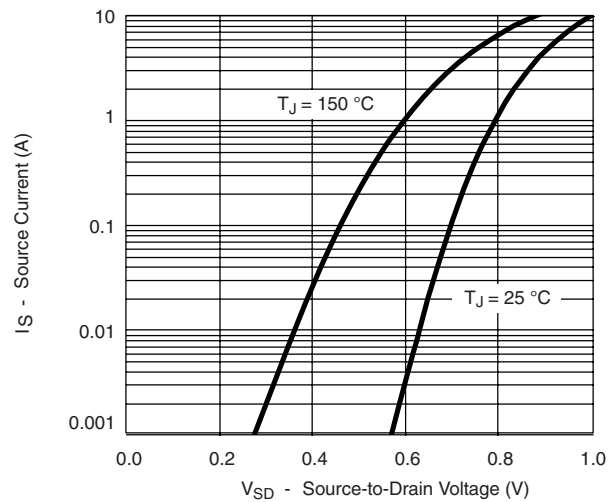


**Gate Charge**

**TYPICAL CHARACTERISTICS** 25 °C unless noted

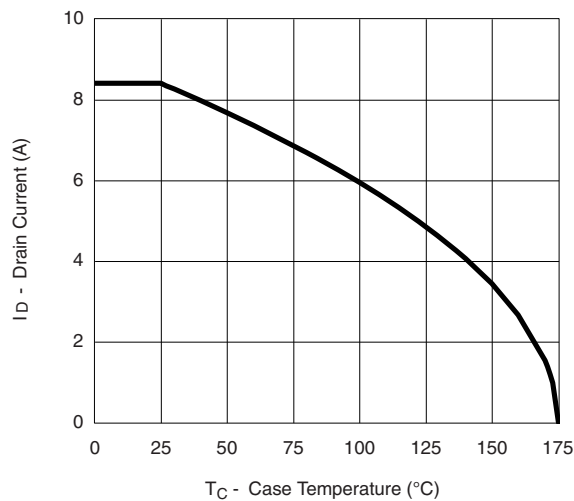


On-Resistance vs. Junction Temperature

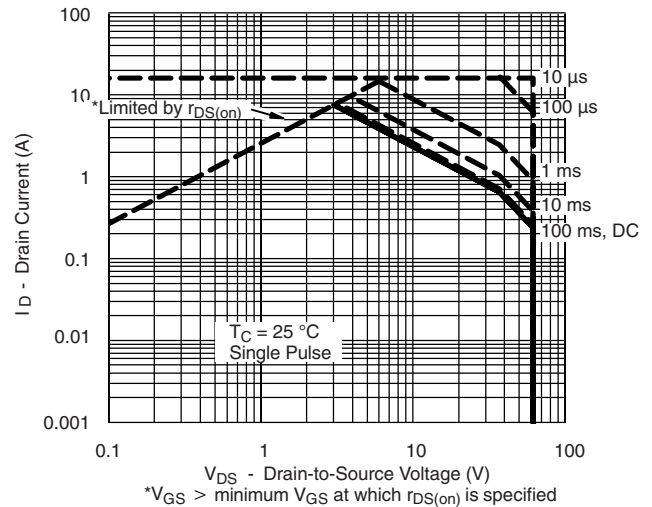


Source-Drain Diode Forward Voltage

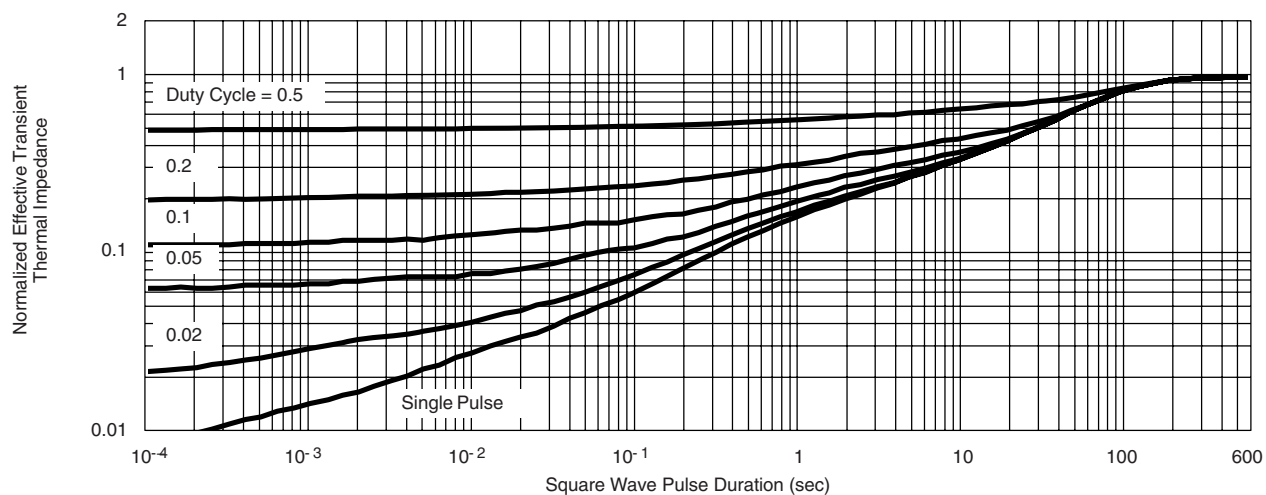
**THERMAL RATINGS**

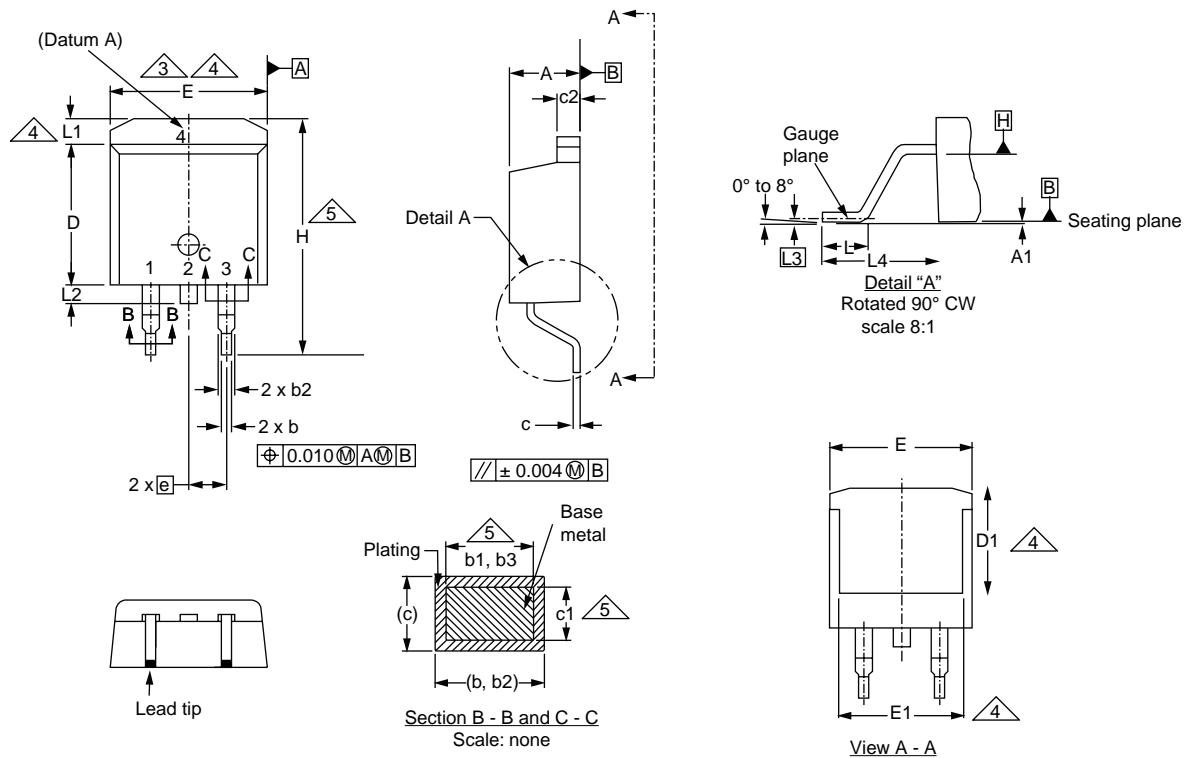


Drain Current vs. Case Temperature



Safe Operating Area

**THERMAL RATINGS****Normalized Thermal Transient Impedance, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Case**

**TO-263AB**

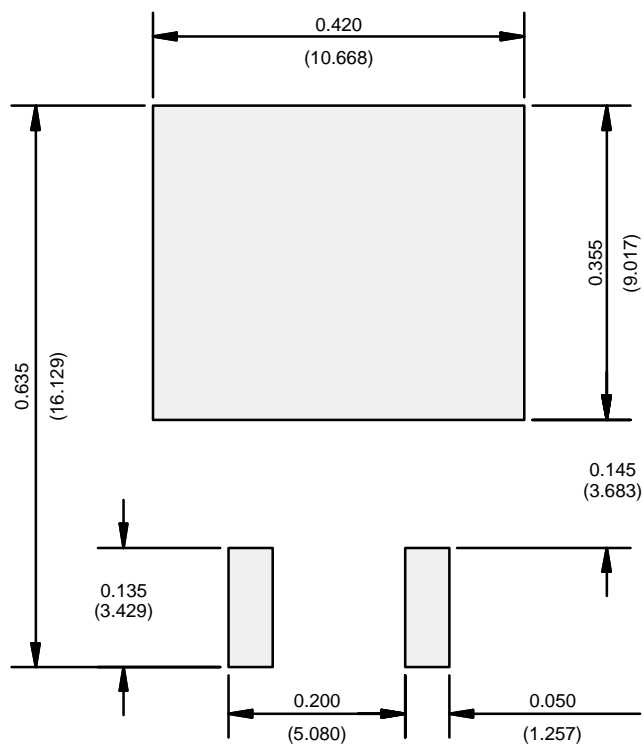
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

ECN: S-82110-Rev. A, 15-Sep-08  
 DWG: 5970

**Notes**

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**

Recommended Minimum Pads  
Dimensions in Inches/(mm)

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