

## P-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY			
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ.)
- 40	0.0081 at $V_{GS} = - 10$ V	- 50 <sup>d</sup>	60
	0.0117 at $V_{GS} = - 4.5$ V	- 48 <sup>d</sup>	

### FEATURES

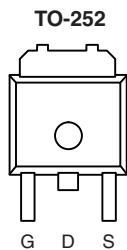
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



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

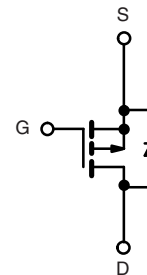
### APPLICATIONS

- Power Switch
- Load Switch in High Current Applications
- DC/DC Converters



Top View

Drain Connected to Tab

**Ordering Information:** SUD50P04-08-GE3 (Lead (Pb)-free and Halogen-free)


P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted					
Parameter	Symbol	Limit	Unit		
Drain-Source Voltage	$V_{DS}$	- 40	V		
Gate-Source Voltage	$V_{GS}$	$\pm 20$			
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	- 50 <sup>d</sup>	A	
		$T_C = 70$ °C	- 50 <sup>d</sup>		
Pulsed Drain Current	$I_{DM}$	- 100			
Avalanche Current	$I_{AS}$	- 46			
Single Avalanche Energy <sup>a</sup>	$E_{AS}$	106	mJ		
Maximum Power Dissipation <sup>a</sup>	$P_D$	$T_C = 25$ °C	73.5 <sup>b</sup>	W	
		$T_A = 25$ °C <sup>c</sup>	2.5		
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C		

THERMAL RESISTANCE RATINGS				
Parameter	Symbol	Limit	Unit	
Junction-to-Ambient (PCB Mount) <sup>c</sup>	$R_{thJA}$	50	°C/W	
Junction-to-Case (Drain)	$R_{thJC}$	1.7		

Notes:

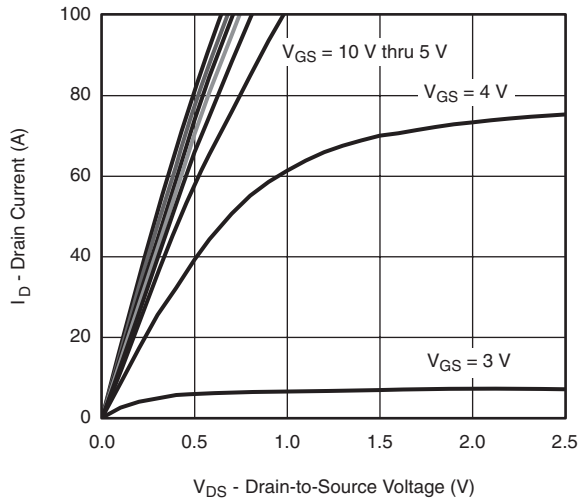
- Duty cycle  $\leq 1$  %.
- See SOA curve for voltage derating.
- When Mounted on 1" square PCB (FR-4 material).
- Package limited.

<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{DS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-40			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-1		-2.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 250$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			-50	
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$			-250	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -10\text{ V}, V_{GS} = -10\text{ V}$	-50			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -22\text{ A}$		0.0067	0.0081	$\Omega$
		$V_{GS} = -4.5\text{ V}, I_D = -19\text{ A}$		0.0097	0.0117	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -22\text{ A}$		45		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = -20\text{ V}, f = 1\text{ MHz}$		5380		$\mu\text{F}$
Output Capacitance	$C_{oss}$			570		
Reverse Transfer Capacitance	$C_{rss}$			500		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = -20\text{ V}, V_{GS} = -10\text{ V}, I_D = -20\text{ A}$		106	159	nC
		$V_{DS} = -20\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -20\text{ A}$		60	90	
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			22		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$		27			
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	0.4	1.8	3.6	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = -20\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong -10\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		15	23	ns
Rise Time <sup>c</sup>	$t_r$			12	18	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			70	105	
Fall Time <sup>c</sup>	$t_f$			18	27	
<b>Drain-Source Body Diode Ratings and Characteristics</b> $T_C = 25\text{ }^\circ\text{C}$ <sup>b</sup>						
Continuous Current	$I_S$				-50	A
Pulsed Current	$I_{SM}$				-100	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = -10\text{ A}, V_{GS} = 0\text{ V}$		-0.8	-1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = -10\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$		35	53	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			-2	-3	A
Reverse Recovery Charge	$Q_{rr}$			33	50	nC

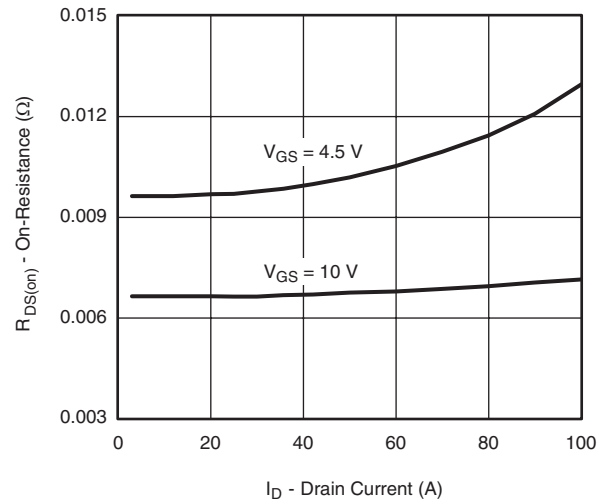
## Notes:

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

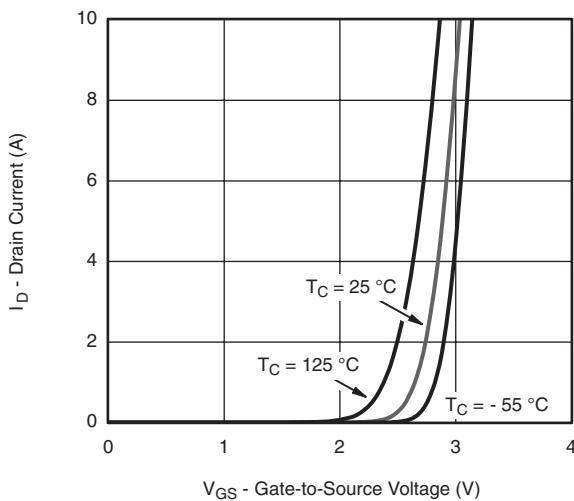
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

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


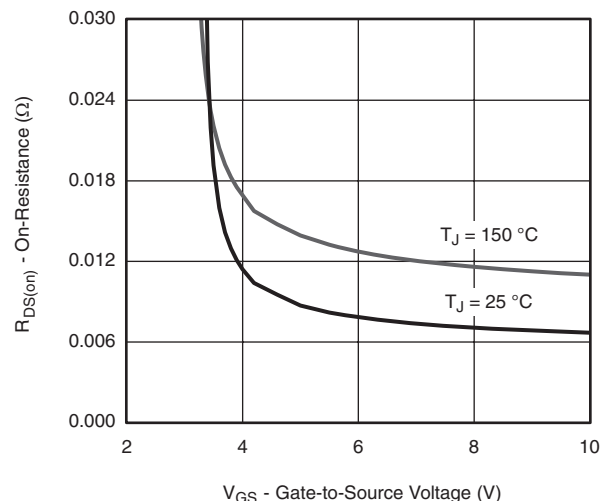
$V_{DS}$  - Drain-to-Source Voltage (V)  
**Output Characteristics**



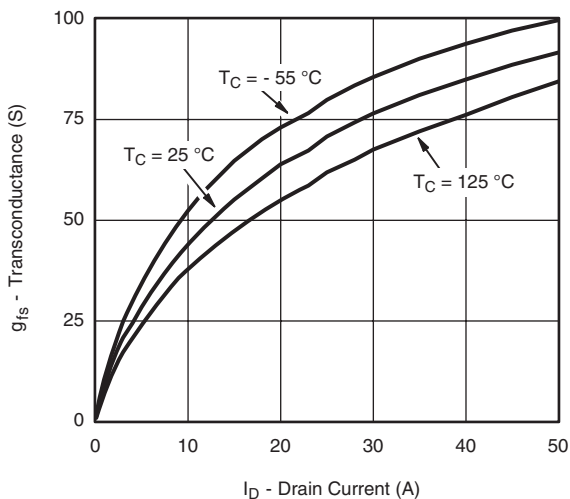
$I_D$  - Drain Current (A)  
**On-Resistance vs. Drain Current**



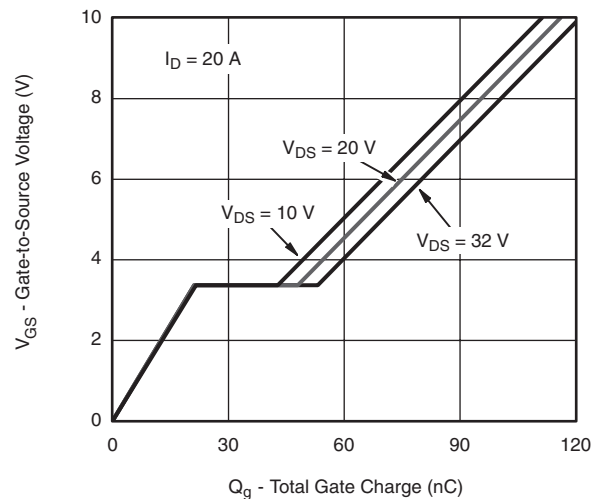
$V_{GS}$  - Gate-to-Source Voltage (V)  
**Transfer Characteristics**



$V_{GS}$  - Gate-to-Source Voltage (V)  
**On-Resistance vs. Gate-to-Source Voltage**

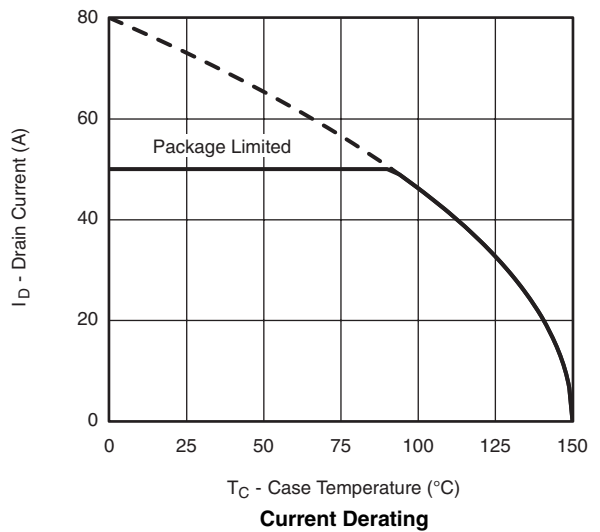
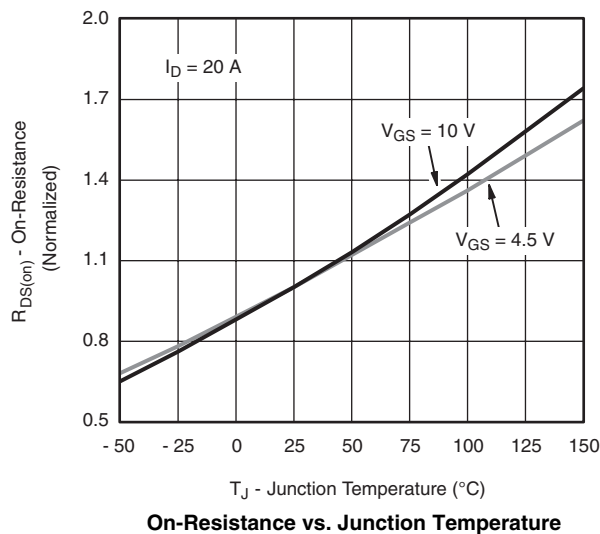
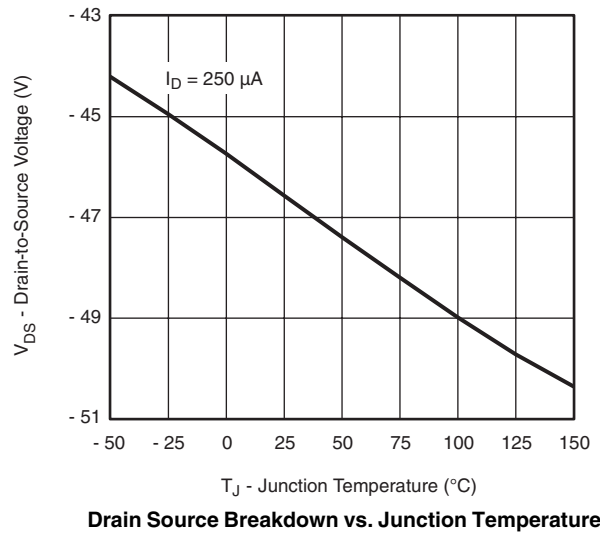
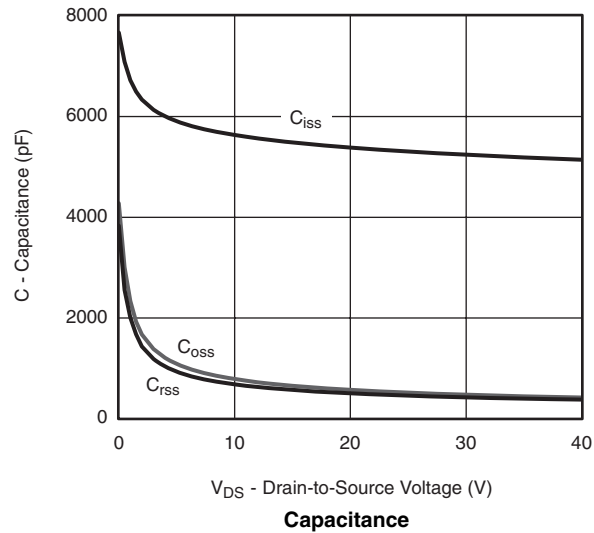
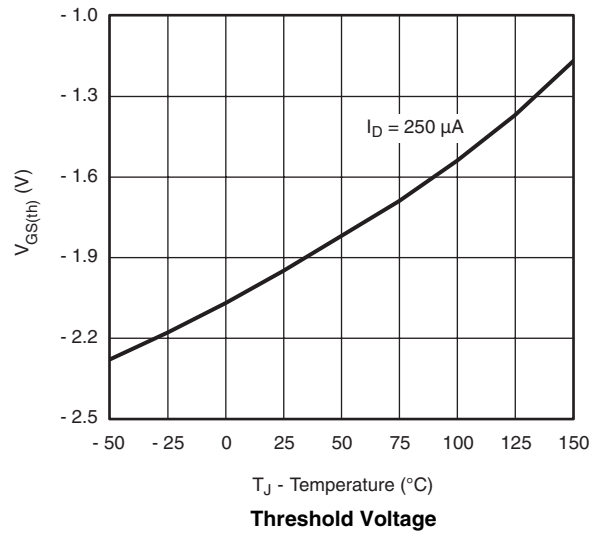
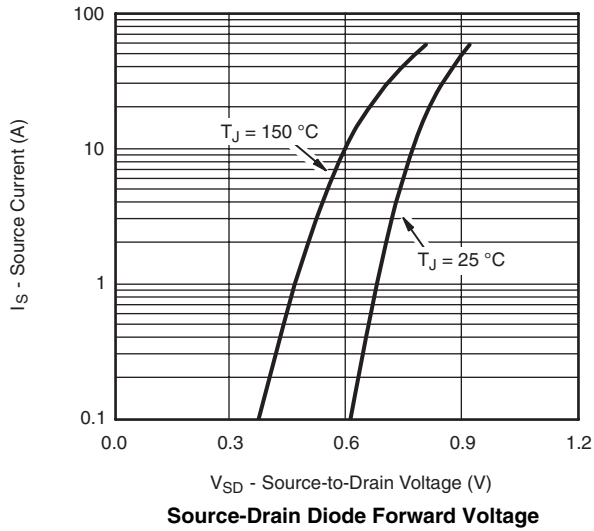


$I_D$  - Drain Current (A)  
**Transconductance**

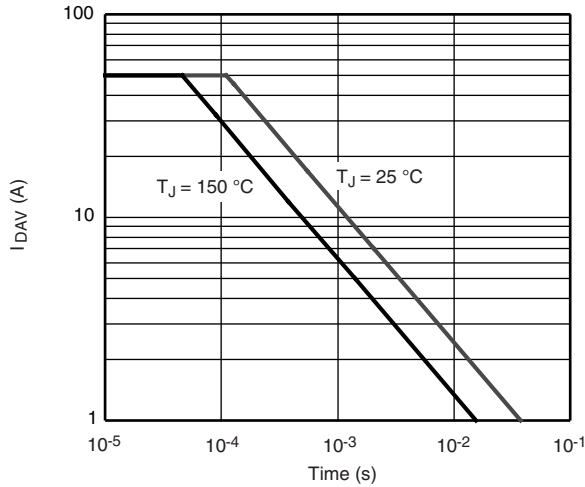


$Q_g$  - Total Gate Charge (nC)  
**Gate Charge**

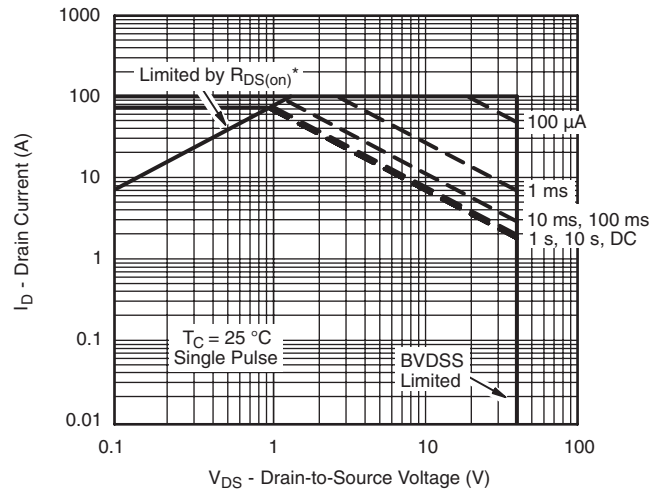
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

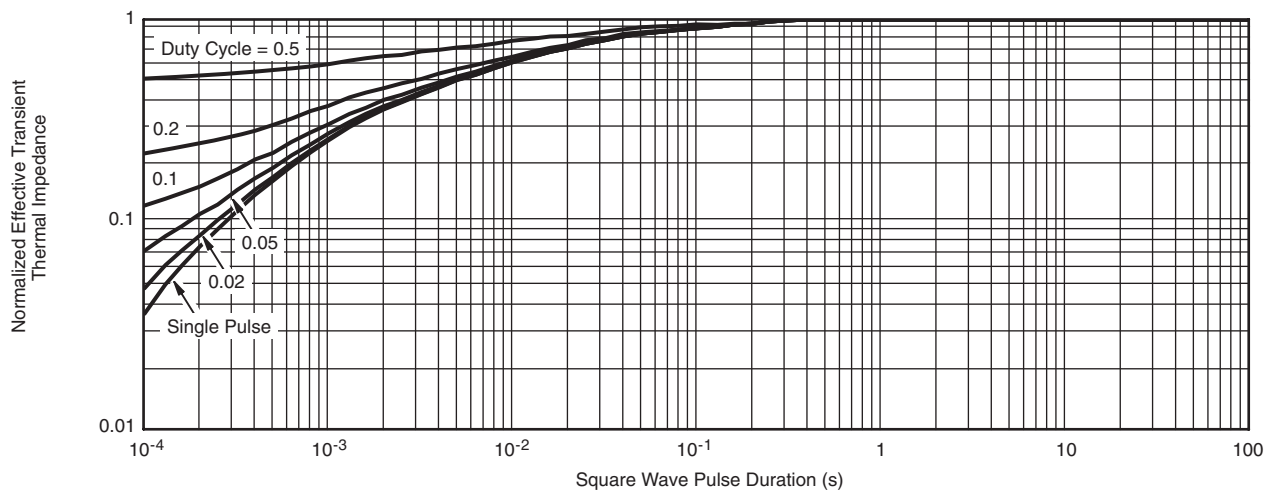


**Single Pulse Avalanche Current Capability vs. Time**



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

**Safe Operating Area**



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

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### TO-252AA Case Outline

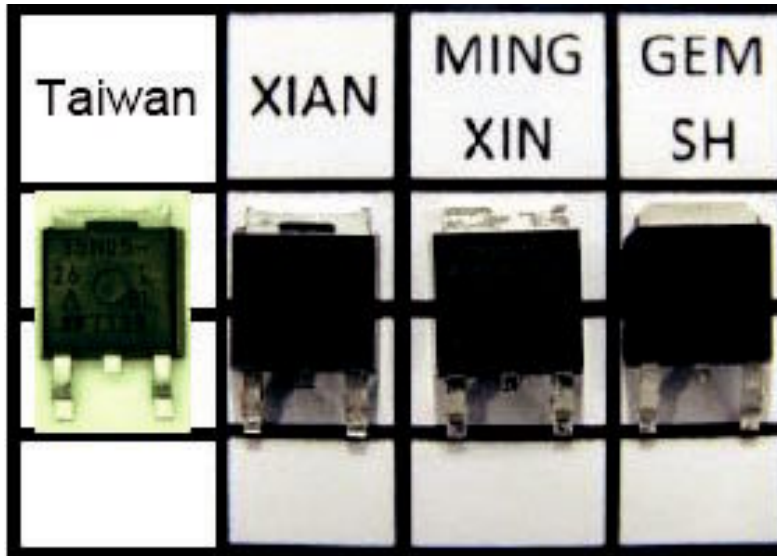


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	4.10	-	0.161	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.01	1.52	0.040	0.060

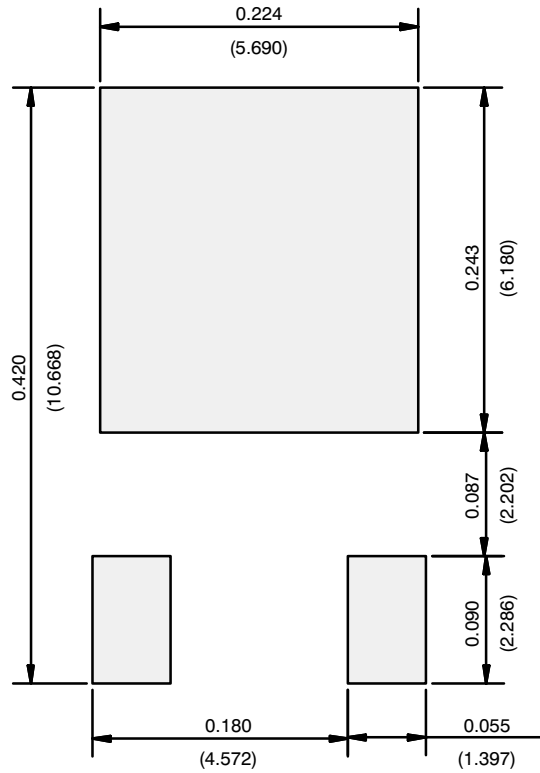
ECN: T13-0359-Rev. O, 03-Jun-13  
DWG: 5347

**Notes**

- Dimension L3 is for reference only.
- Xi'an, Mingxin, and GEM SH actual photo.



## RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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