

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

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)	Q <sub>g</sub> (TYP.)
-40	0.0081 at V <sub>GS</sub> = -10 V	-50 <sup>d</sup>	60
	0.0117 at V <sub>GS</sub> = -4.5 V	-48 <sup>d</sup>	

### FEATURES

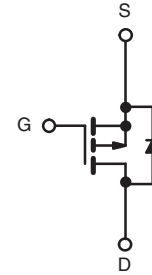
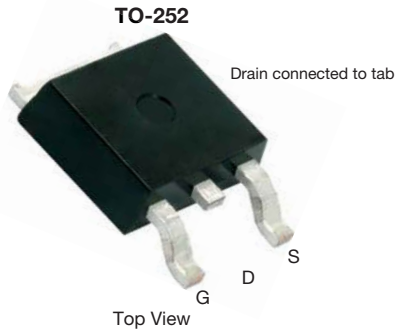
- TrenchFET® power MOSFET
- 100 % R<sub>g</sub> and UIS tested
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Power switch
- Load switch in high current applications
- DC/DC converters



P-Channel MOSFET

### Ordering Information:

SUD50P04-08-GE3 (lead (Pb)-free and halogen-free)

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V <sub>DS</sub>	-40	V	
Gate-Source Voltage	V <sub>GS</sub>	± 20		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	A	
		T <sub>C</sub> = 70 °C		
Pulsed Drain Current	I <sub>DM</sub>	-100		
Avalanche Current	I <sub>AS</sub>	-46		
Single Avalanche Energy <sup>a</sup>	E <sub>AS</sub>	106	mJ	
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>C</sub> = 25 °C	73.5 <sup>b</sup>	
		T <sub>A</sub> = 25 °C <sup>c</sup>	2.5	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C	

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	LIMIT	UNIT	
Junction-to-Ambient (PCB Mount) <sup>c</sup>	R <sub>thJA</sub>	50	°C/W	
Junction-to-Case (Drain)	R <sub>thJC</sub>	1.7		

### Notes

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



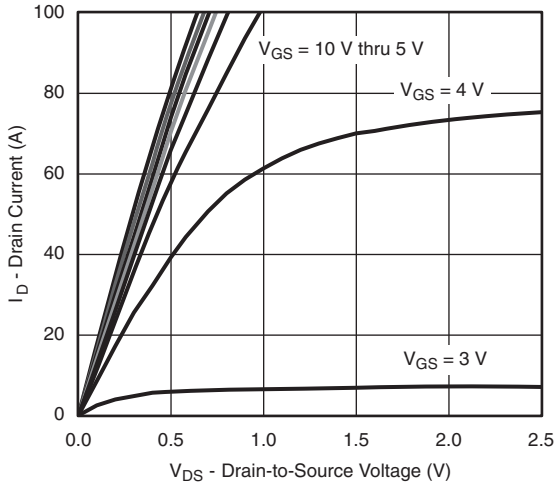
SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	-40	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	-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 (<math>T_C = 25\text{ }^\circ\text{C}</math>) <sup>b</sup></b>						
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**

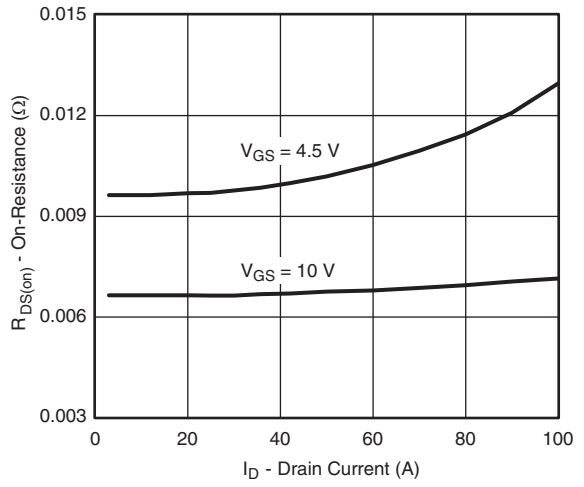
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.  
c. Independent of operating temperature.

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.

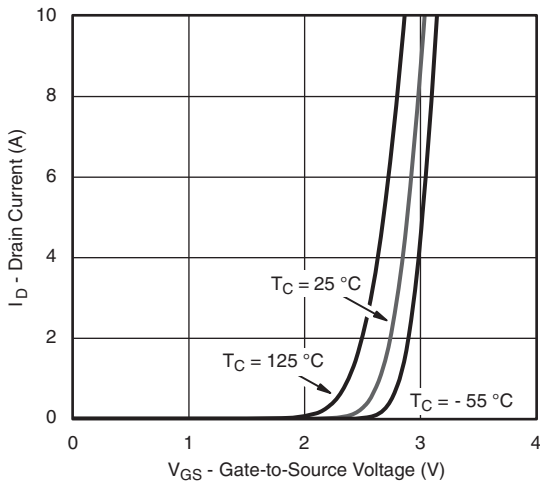
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



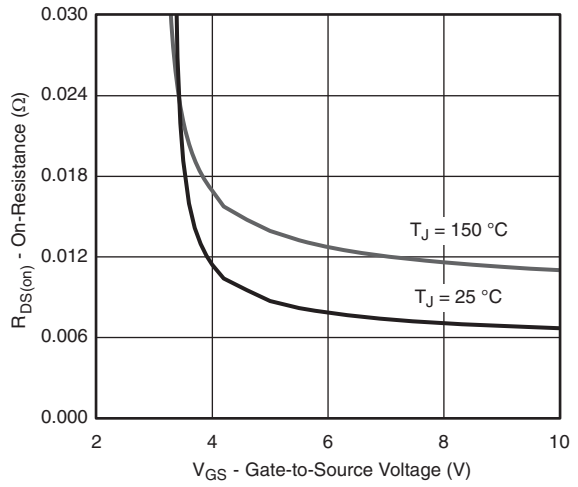
**Output Characteristics**



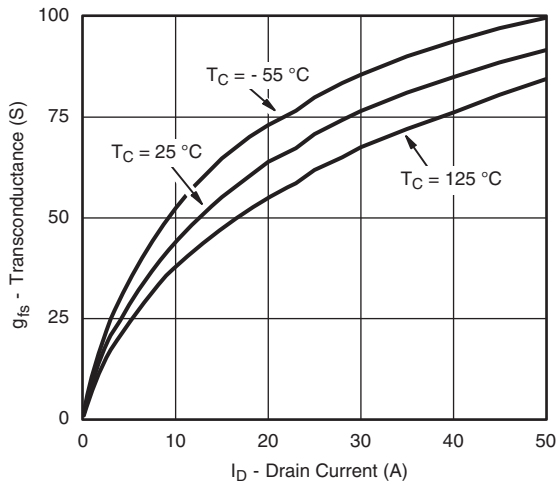
**On-Resistance vs. Drain Current**



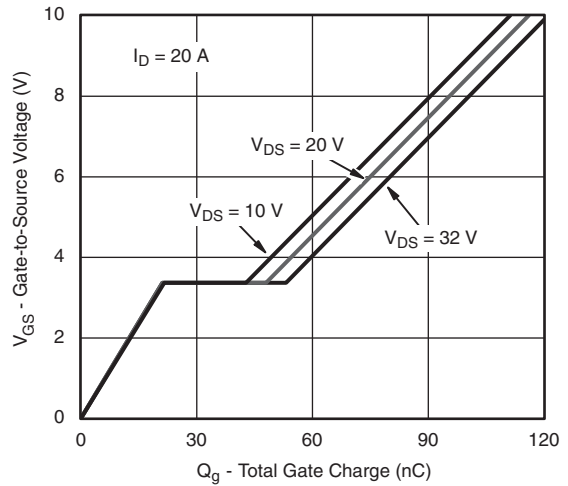
**Transfer Characteristics**



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



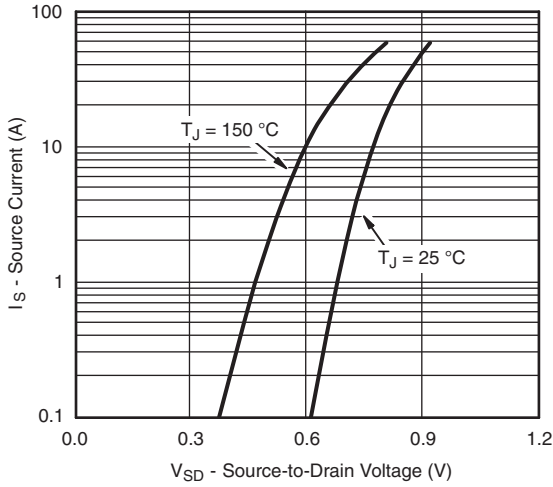
**Transconductance**



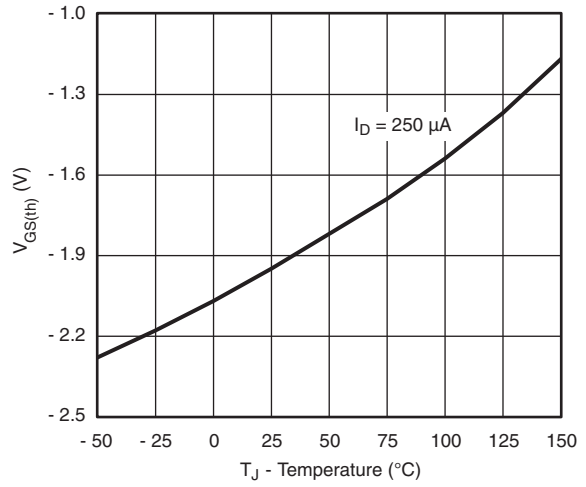
**Gate Charge**



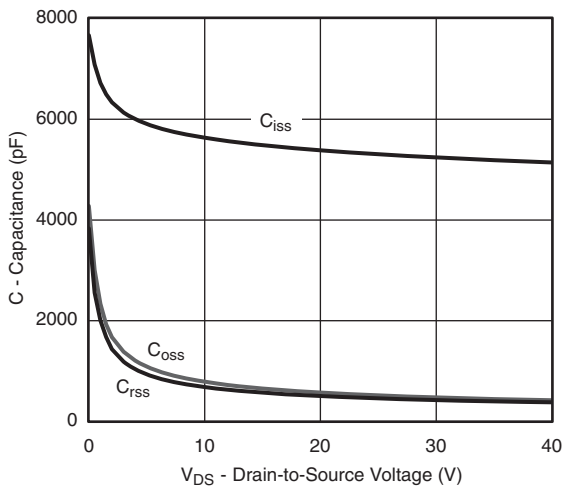
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



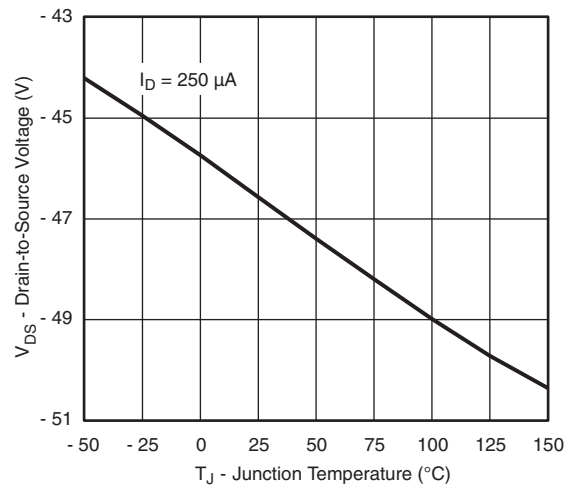
Source-Drain Diode Forward Voltage



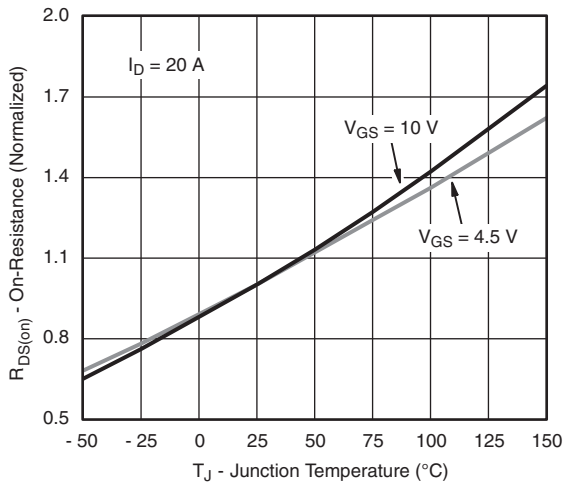
Threshold Voltage



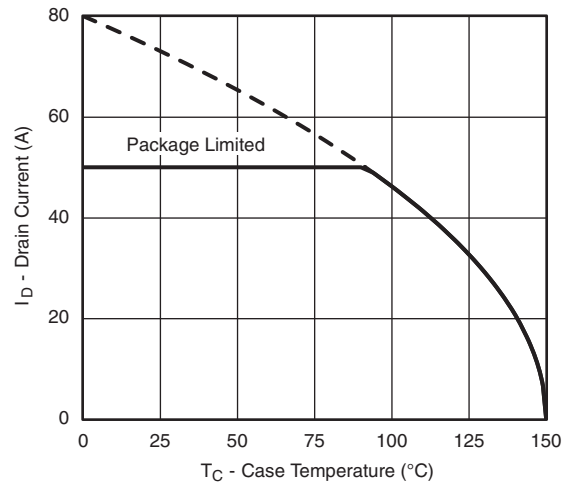
Capacitance



Drain Source Breakdown vs. Junction Temperature



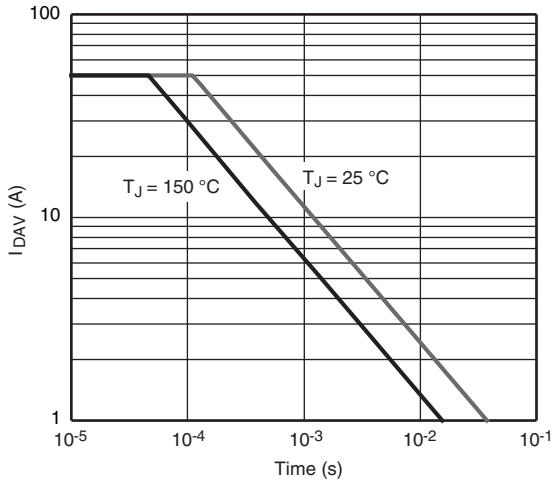
On-Resistance vs. Junction Temperature



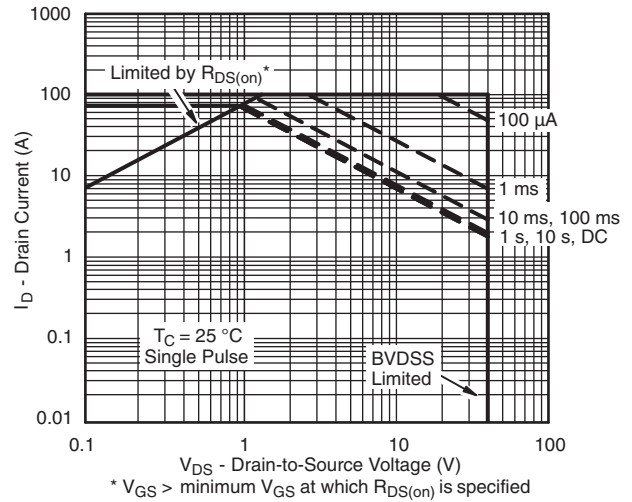
Current Derating



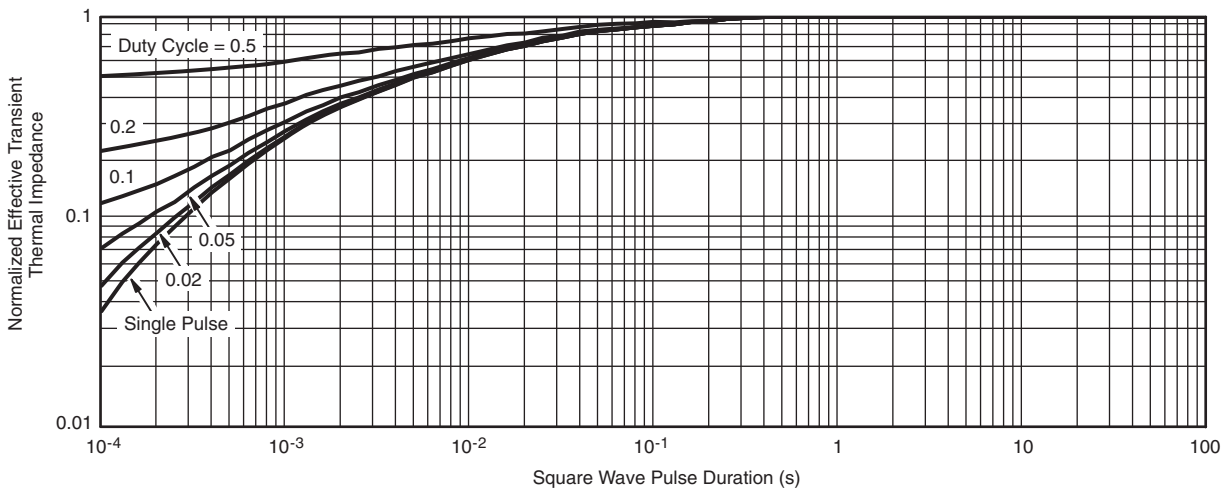
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Single Pulse Avalanche Current Capability vs. Time



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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# TO-252AA Case Outline

## VERSION 1: FACILITY CODE = Y



MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

### Note

- Dimension L3 is for reference only



VERSION 2: FACILITY CODE = N



MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.39
A1	-	0.13
b	0.65	0.89
b1	0.64	0.79
b2	0.76	1.13
b3	4.95	5.46
c	0.46	0.61
c1	0.41	0.56
c2	0.46	0.60
D	5.97	6.22
D1	5.21	-
E	6.35	6.73
E1	4.32	-
e	2.29 BSC	
H	9.94	10.34

MILLIMETERS		
DIM.	MIN.	MAX.
L	1.50	1.78
L1	2.74 ref.	
L2	0.51 BSC	
L3	0.89	1.27
L4	-	1.02
L5	1.14	1.49
L6	0.65	0.85
θ	0°	10°
θ1	0°	15°
θ2	25°	35°

Notes

- Dimensioning and tolerance confirm to ASME Y14.5M-1994
- All dimensions are in millimeters. Angles are in degrees
- Heat sink side flash is max. 0.8 mm
- Radius on terminal is optional

ECN: E19-0649-Rev. Q, 16-Dec-2019  
 DWG: 5347

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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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