

N-Channel 60 V (D-S), MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
60	0.031 at $V_{GS} = 10$ V	9.1	6.5 nC
	0.045 at $V_{GS} = 4.5$ V	7.6	

FEATURES

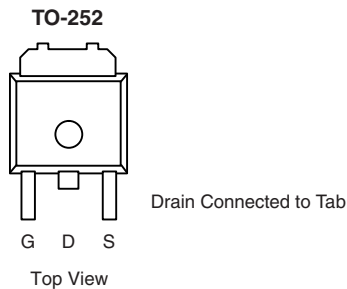
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



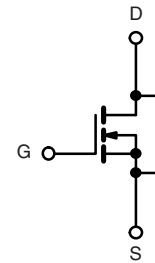
RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- DC/DC Converters



Ordering Information: SUD23N06-31-GE3 (Lead (Pb)-free and Halogen-free)



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}	± 20	
Continuous Drain Current ($T_J = 150$ °C)	$T_C = 25$ °C	21.4	A
	$T_C = 70$ °C	17.1	
	$T_A = 25$ °C	9.1 ^a	
	$T_A = 70$ °C	7.6 ^a	
Pulsed Drain Current	I_{DM}	50	mJ
Continuous Source-Drain Diode Current	$T_C = 25$ °C	20.8	
	$T_A = 25$ °C	3.8 ^a	
Single Pulse Avalanche Current	$L = 0.1$ mH	20	mJ
Avalanche Energy	E_{AS}	20	
Maximum Power Dissipation	$T_C = 25$ °C	31.25	W
	$T_C = 70$ °C	20	
	$T_A = 25$ °C	5.7 ^a	
	$T_A = 70$ °C	3.6 ^a	
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 ^a	$t \leq 10$ s	R_{thJA}	18	°C/W
Maximum Junction-to-Case	Steady State	R_{thJC}	3.2	

Notes:

a. Surface mounted on 1" x 1" FR4 board, $t \leq 10$ s.

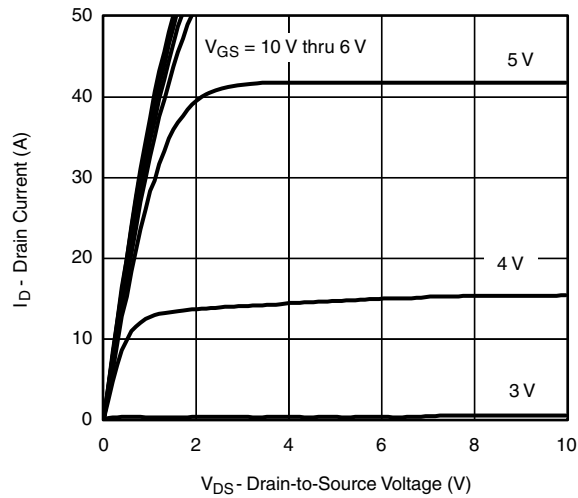
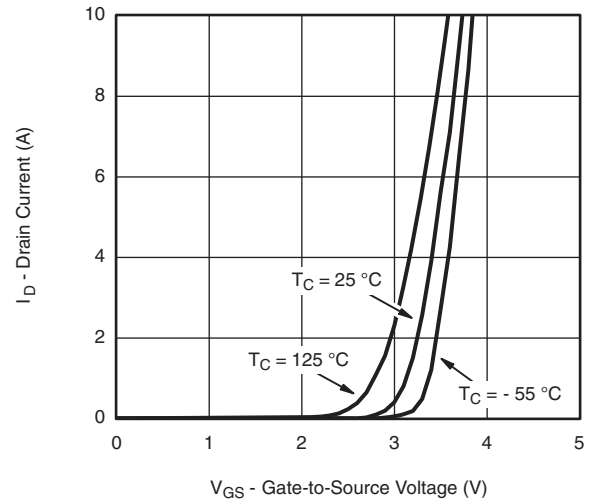
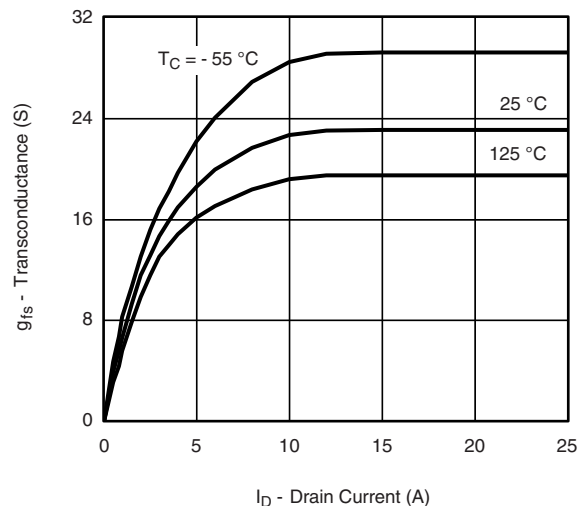
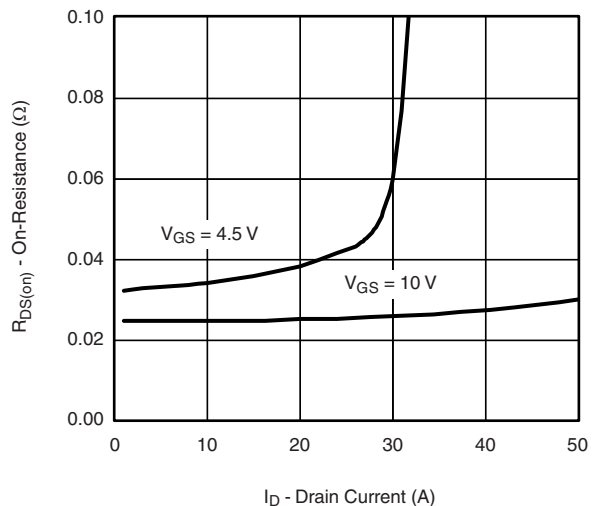
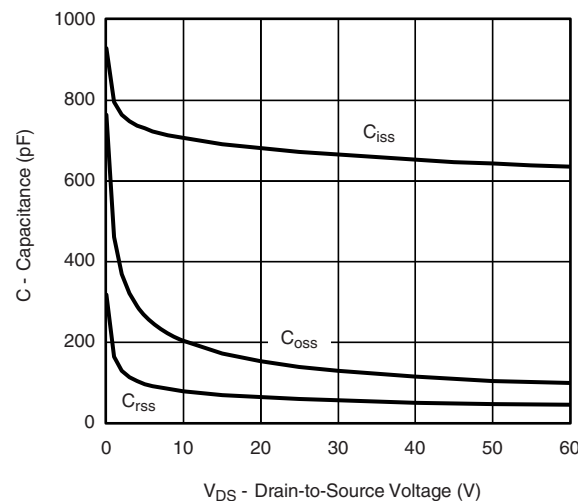
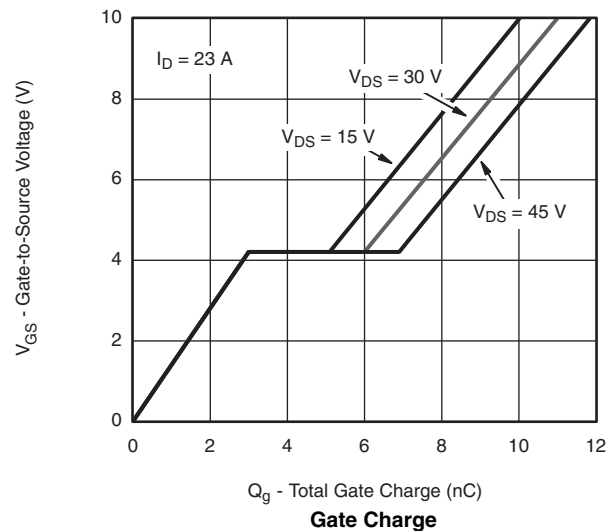
SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	60			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA		65		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 6.3		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.0		3.0	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 60 V, V _{GS} = 0 V			1	μA
		V _{DS} = 60 V, V _{GS} = 0 V, T _J = 70 °C			20	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	50			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 15 A		0.025	0.031	Ω
		V _{GS} = 4.5 V, I _D = 10 A		0.037	0.045	
Forward Transconductance ^a	g _{fs}	V _{DS} = 15 V, I _D = 15 A		20		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz		670		pF
Output Capacitance	C _{oss}			140		
Reverse Transfer Capacitance	C _{rss}			60		
Total Gate Charge	Q _g	V _{DS} = 30 V, V _{GS} = 10 V, I _D = 23 A		11	17	nC
		V _{DS} = 30 V, V _{GS} = 4.5 V, I _D = 23 A		6.5	13	
Gate-Source Charge	Q _{gs}			3.0		
Gate-Drain Charge	Q _{gd}			3.0		
Gate Resistance	R _g	f = 1 MHz		1.6	3.2	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = 30 V, R _L = 1.3 Ω I _D ≅ 23 A, V _{GEN} = 4.5 V, R _g = 1 Ω		18	30	ns
Rise Time	t _r			250	400	
Turn-Off Delay Time	t _{d(off)}			35	55	
Fall Time	t _f			68	110	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 30 V, R _L = 1.3 Ω I _D ≅ 23 A, V _{GEN} = 10 V, R _g = 1 Ω		8	15	
Rise Time	t _r			15	25	
Turn-Off Delay Time	t _{d(off)}			30	45	
Fall Time	t _f			25	40	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			20.8	A
Pulse Diode Forward Current ^a	I _{SM}				50	
Body Diode Voltage	V _{SD}	I _S = 15 A		1.0	1.5	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 15 A, dI/dt = 100 A/μs, T _J = 25 °C		30	60	ns
Body Diode Reverse Recovery Charge	Q _{rr}			35	70	nC
Reverse Recovery Fall Time	t _a			20		ns
Reverse Recovery Rise Time	t _b			10		

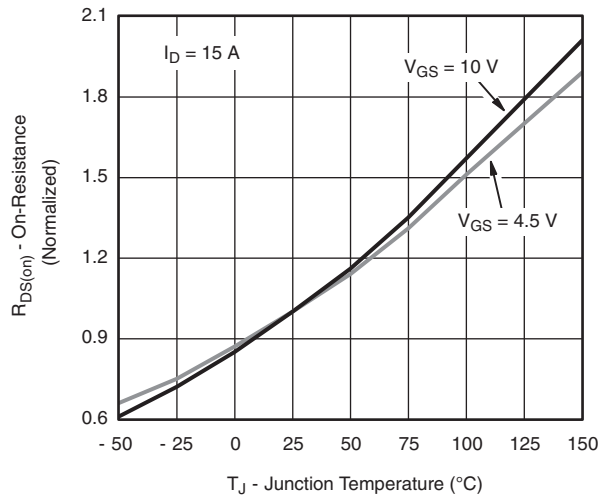
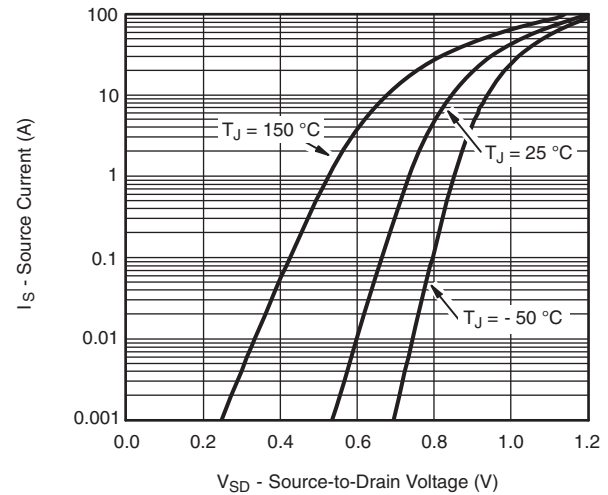
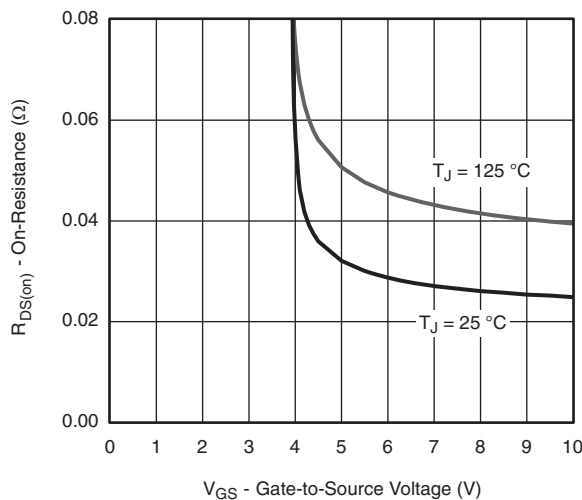
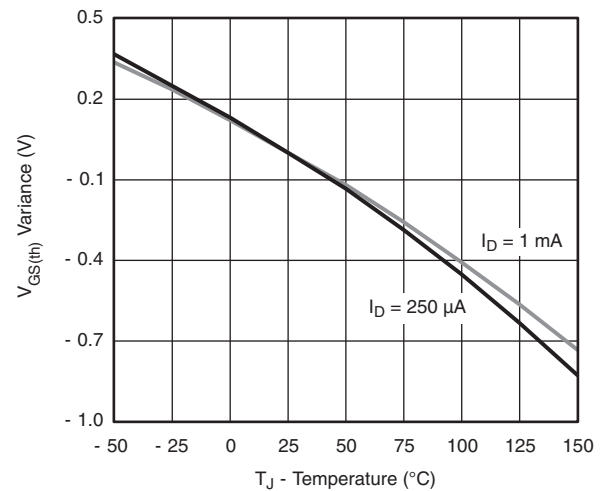
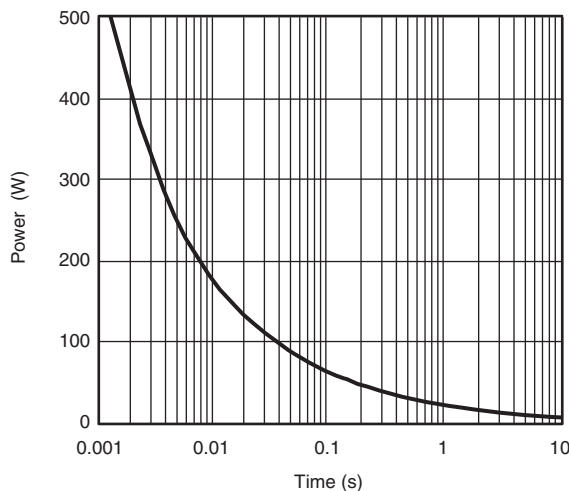
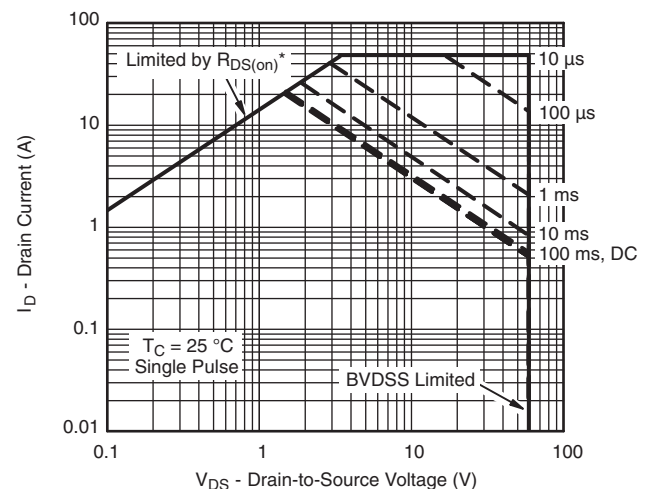
Notes:

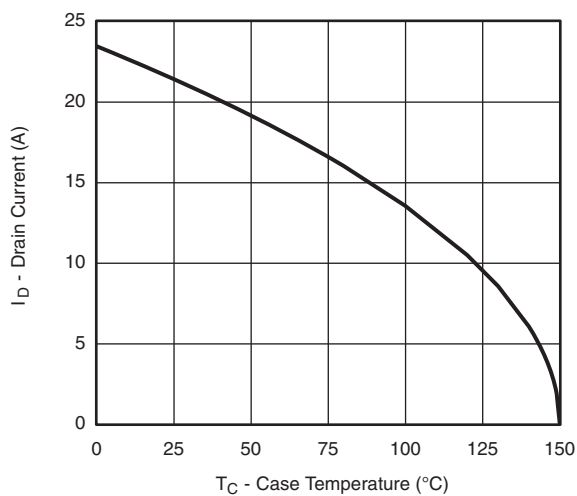
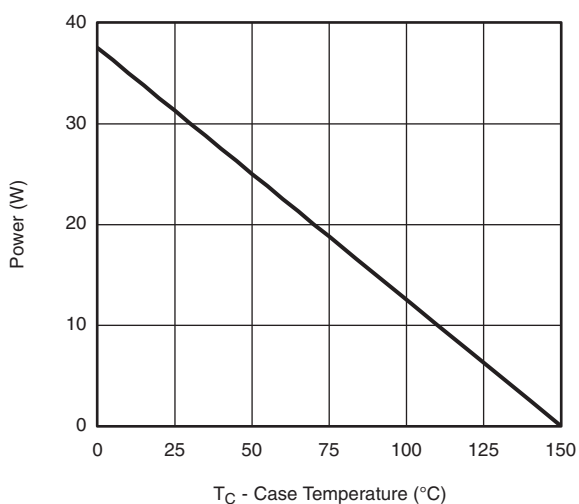
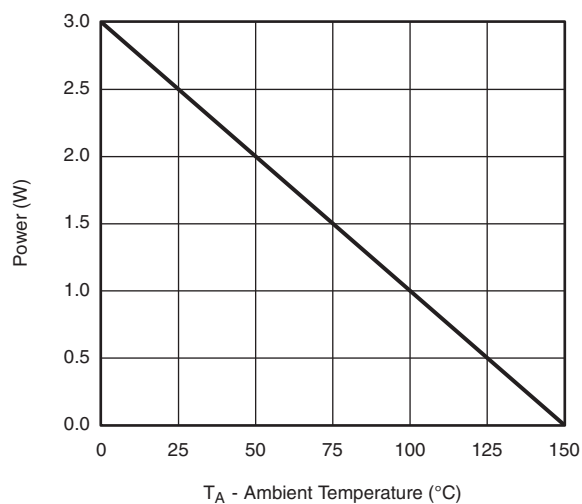
a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

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

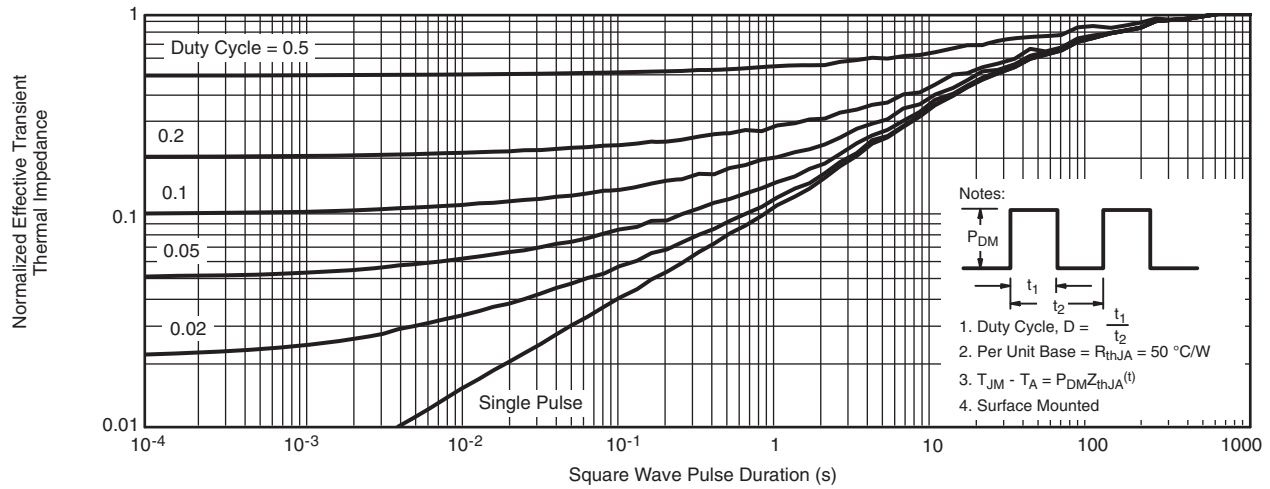
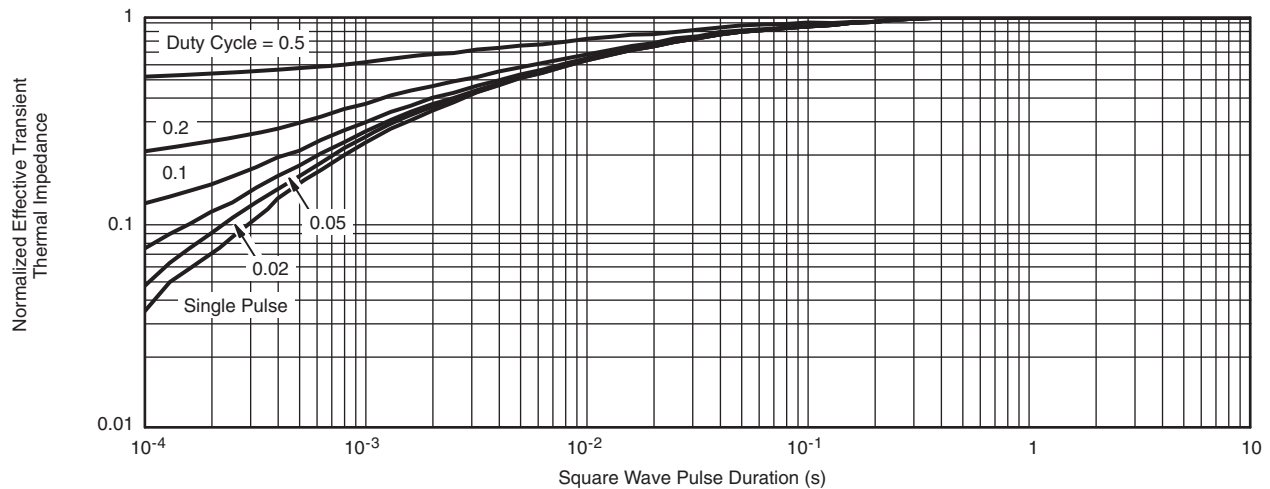
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Output Characteristics

Transfer Characteristics

Transconductance

On-Resistance vs. Drain Current

Capacitance

Gate Charge

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)**On-Resistance vs. Junction Temperature****Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power, Junction-to-Ambient*** $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified**Single Pulse Power, Junction-to-Case**

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating*, Junction-to-Case

Power, Junction-to-Case

Power, Junction-to-Ambient

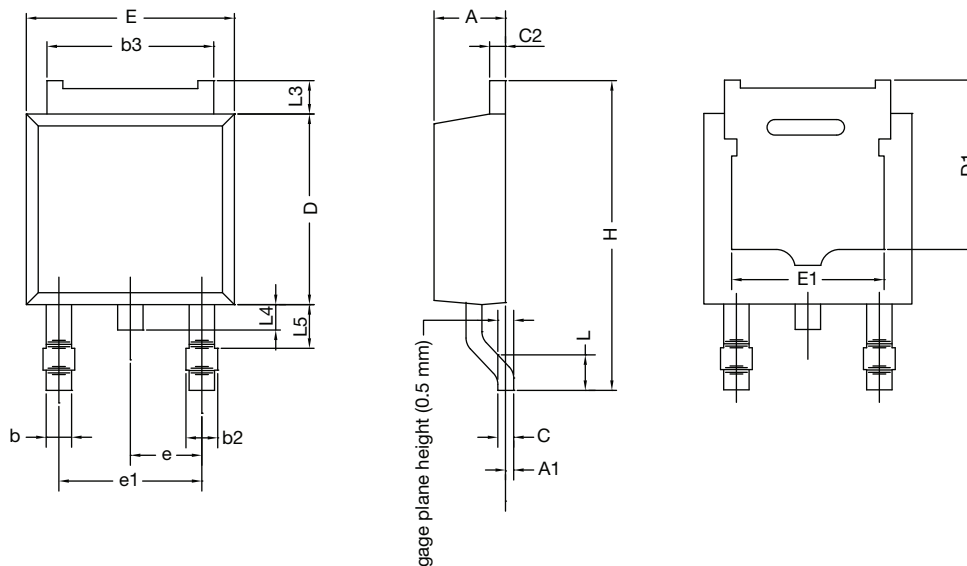
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)**Normalized Thermal Transient Impedance, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Case**

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TO-252AA Case Outline

VERSION 1: FACILITY CODE = Y



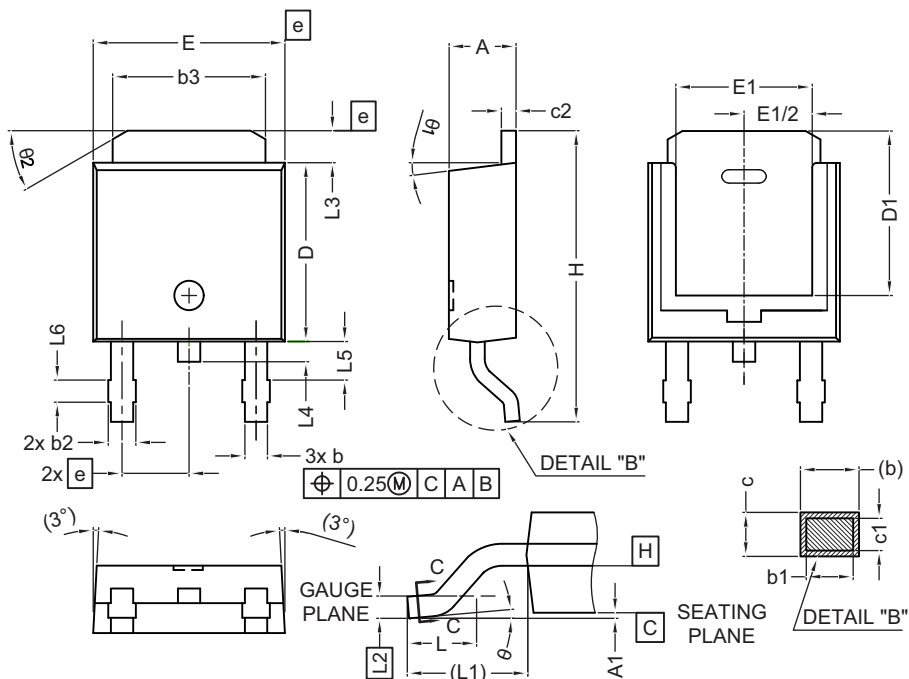
MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

Note

- Dimension L3 is for reference only



VERSION 2: FACILITY CODE = N



DIM.	MILLIMETERS	
	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

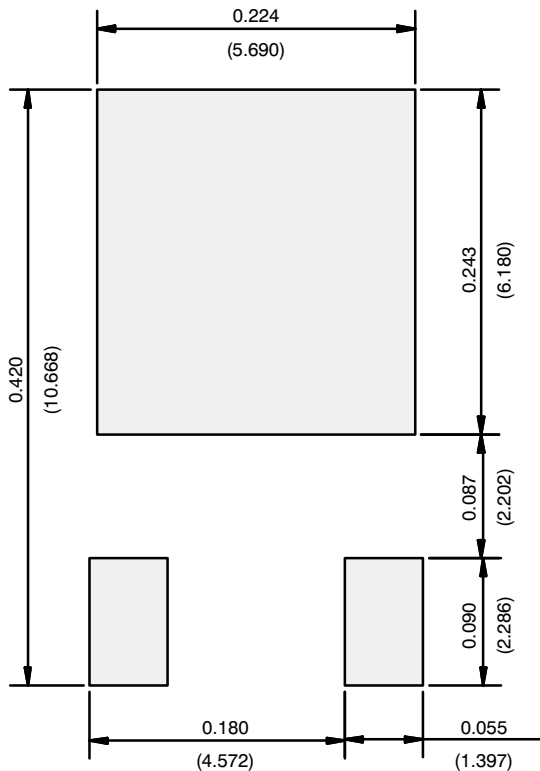
DIM.	MILLIMETERS	
	MIN.	MAX.
L	1.50	1.78
L1	2.74 ref.	
L2	0.51 BSC	
L3	0.89	1.27
L4	-	1.02
L5	1.14	1.49
L6	0.65	0.85
theta	0°	10°
theta1	0°	15°
theta2	25°	35°

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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