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

PRODUCT SUMMARY	
V_{DS} (V)	60
$R_{DS(on)}$ max. (Ω) at V_{GS} = 10 V	0.024
$R_{DS(on)}$ max. (Ω) at V_{GS} = 4.5 V	0.028
Q_g typ. (nC)	5.2
I_D (A)	15[a, g]
Configuration	Single

FEATURES

- **Halogen-free According to IEC 61249-2-21 Available**
- TrenchFET® Power MOSFET
- 100 % R_g Tested
- 100 % UIS Tested

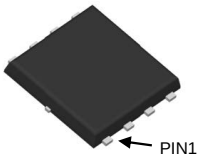
Pb-free
RoHS COMPLIANT

APPLICATIONS

- Battery Switch
- DC/DC Converter

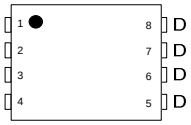
DFN5X6

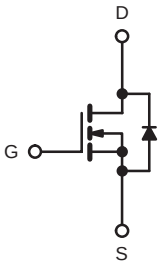
Top View



Bottom View

Top View





N-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}	± 20	
Continuous drain current (T_J = 150 °C)	T_C = 25 °C	I_D	15 [a]	A
	T_C = 70 °C		9[a]	
	T_A = 25 °C		10.3 [b, c]	
	T_A = 70 °C		8.1 [b, c]	
Pulsed drain current (t = 100 µs)		I_{DM}	40	
Continuous source-drain diode current	T_C = 25 °C	I_S	12 [a]	
	T_A = 25 °C		3 [b, c]	
Single pulse avalanche current	L = 0.1 mH	I_{AS}	15	
Single pulse avalanche energy		E_{AS}	11.3	mJ
Maximum power dissipation	T_C = 25 °C	P_D	35.7	W
	T_C = 70 °C		22.9	
	T_A = 25 °C		3.6 [b, c]	
	T_A = 70 °C		2.3 [b, c]	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +150	°C
Soldering recommendations (peak temperature) [c]			260	

THERMAL RESISTANCE RATINGS					
PARAMETER		**SYMBOL**	**TYPICAL**	**MAXIMUM**	**UNIT**
Maximum junction-to-ambient [b]	t ≤ 10 s	R_{thJA}	25	35	°C/W
Maximum junction-to-case (drain)	Steady state	R_{thJC}	2.7	3.5	

Notes
a. Package limited
b. Surface mounted on 1" x 1" FR4 board
c. t = 10 s

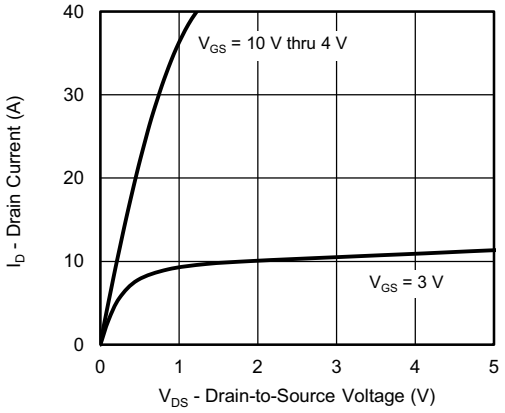
SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	60	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA	-	33	-	mV/°C
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	-4.8	-	
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	1	-	2.8	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	-	-	10	
On-state drain current [a]	$I_{D(on)}$	V_{DS} ≥ 5 V, V_{GS} =10 V	10	-	-	A
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} =10 V, I_D = 10 A	-	0.024	-	Ω
		V_{GS} = 4.5 V, I_D = 5 A	-	0.028	-	
Forward transconductance [a]	g_{fs}	V_{DS} = 10 V, I_D = 10 A	-	39	-	S
Dynamic [b]						
Input capacitance	C_{iss}	V_{DS} = 30 V, V_{GS} = 0 V, f = 1 MHz	-	790	-	pF
Output capacitance	C_{oss}		-	330	-	
Reverse transfer capacitance	C_{rss}		-	14	-	
Total gate charge	Q_g	V_{DS} = 30 V, V_{GS} = 10 V, I_D = 5 A	-	11.1	17	nC
		V_{DS} = 30 V, V_{GS} = 4.5 V, I_D = 5 A	-	5.2	8	
Gate-source charge	Q_{gs}		-	2.2	-	
Gate-drain charge	Q_{gd}		-	1.1	-	
Gate resistance	R_g	f = 1 MHz	0.1	0.6	1.2	Ω
Turn-on delay time	$t_{d(on)}$	V_{DD} = 30 V, R_L = 6 Ω, I_D ≅ 5 A, V_{GEN} = 10 V, R_g = 1 Ω	-	7	15	ns
Rise time	t_r		-	21	40	
Turn-off delay time	$t_{d(off)}$		-	10	20	
Fall time	t_f		-	10	20	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 30 V, R_L = 6 Ω, I_D ≅ 5 A, V_{GEN} = 4.5 V, R_g = 1 Ω	-	13	25	
Rise time	t_r		-	25	50	
Turn-off delay time	$t_{d(off)}$		-	10	20	
Fall time	t_f		-	22	45	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	T_C = 25 °C	-	15	-	A
Pulse diode forward current	I_{SM}		-	-	40	
Body diode voltage	V_{SD}	I_S = 5 A, V_{GS} = 0 V	-	0.79	1.2	V
Body diode reverse recovery time	t_{rr}	I_F = 5 A, di/dt = 100 A/µs, T_J = 25 °C	-	30	60	ns
Body diode reverse recovery charge	Q_{rr}		-	60	120	nC
Reverse recovery fall time	t_a		-	15	-	ns
Reverse recovery rise time	t_b		-	15	-	

Notes

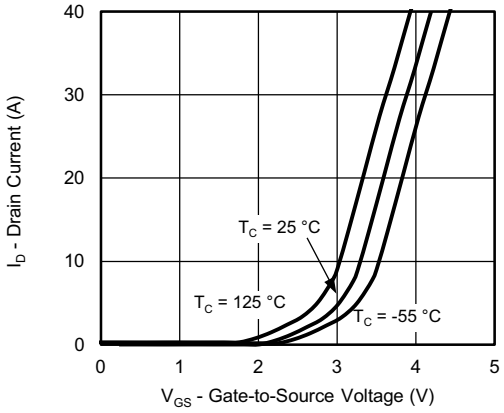
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %

b. Guaranteed by design, not subject to production testing

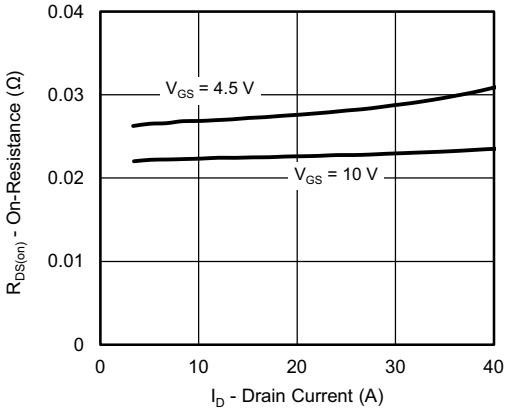
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



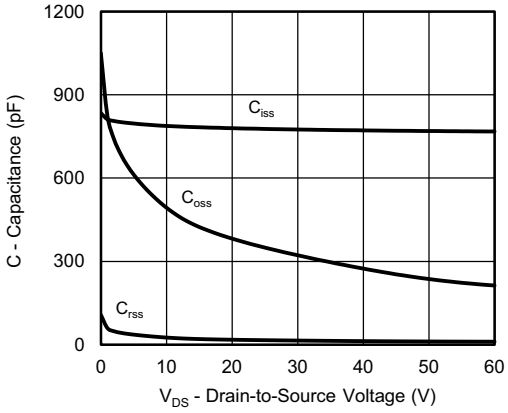
Output Characteristics



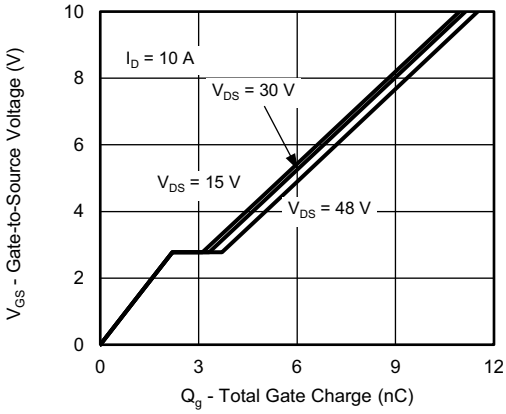
Transfer Characteristics



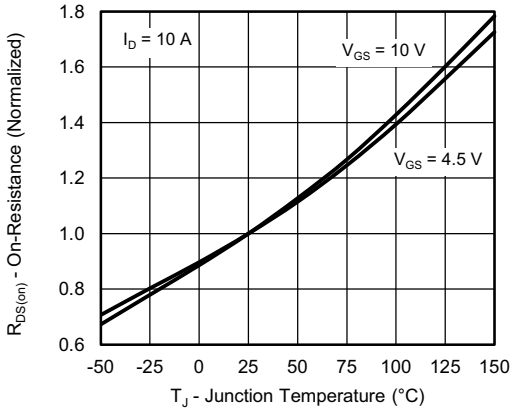
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

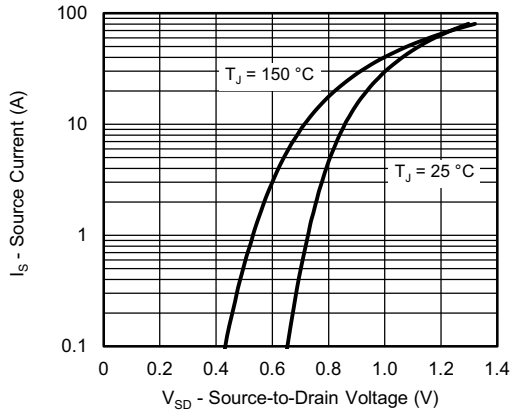


Gate Charge

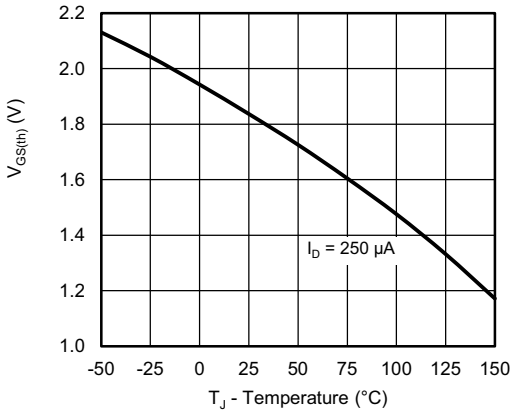


On-Resistance vs. Junction Temperature

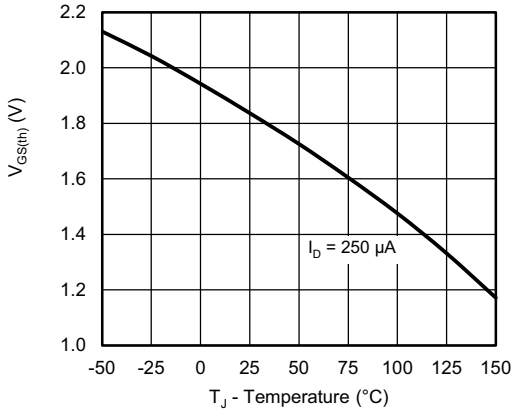
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



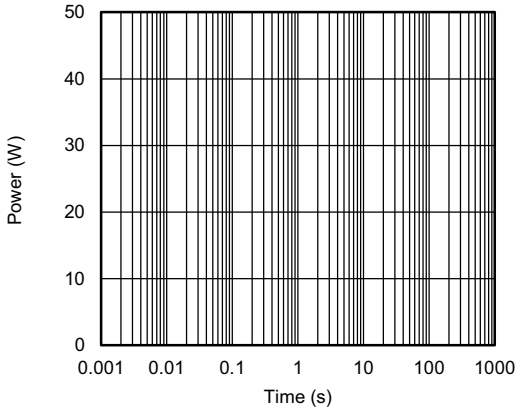
Source-Drain Diode Forward Voltage



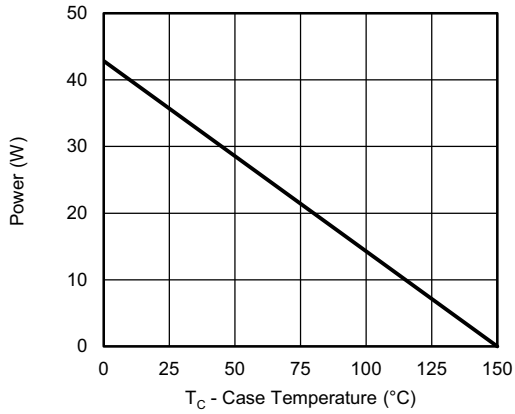
Threshold Voltage



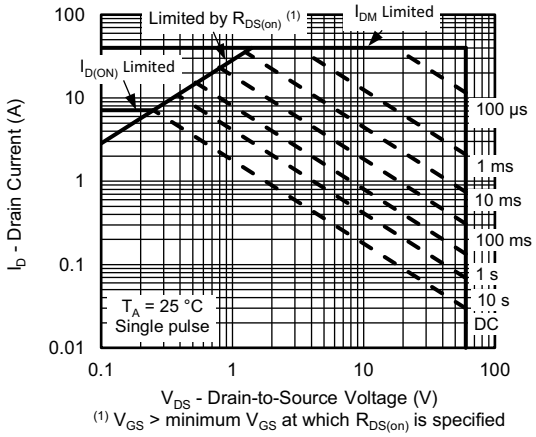
Threshold Voltage



Single Pulse Power, Junction-to-Ambient

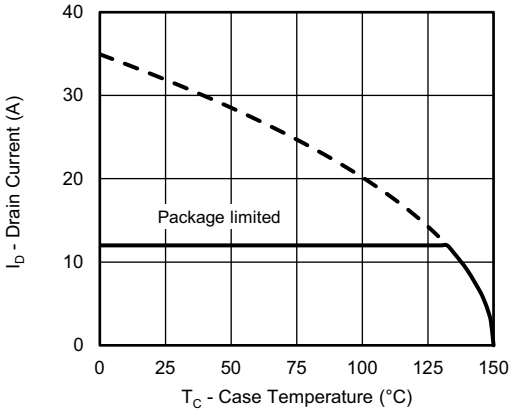


Power, Junction-to-Case



Safe Operating Area, Junction-to-Ambient

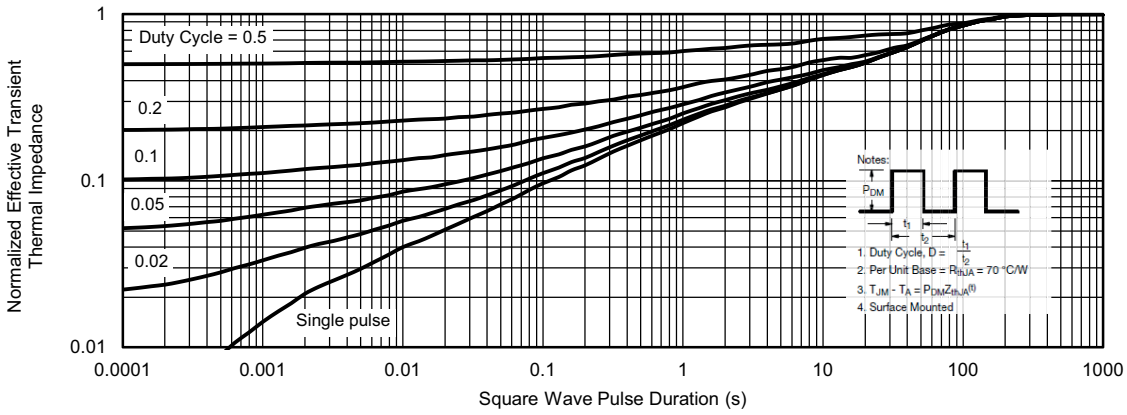
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



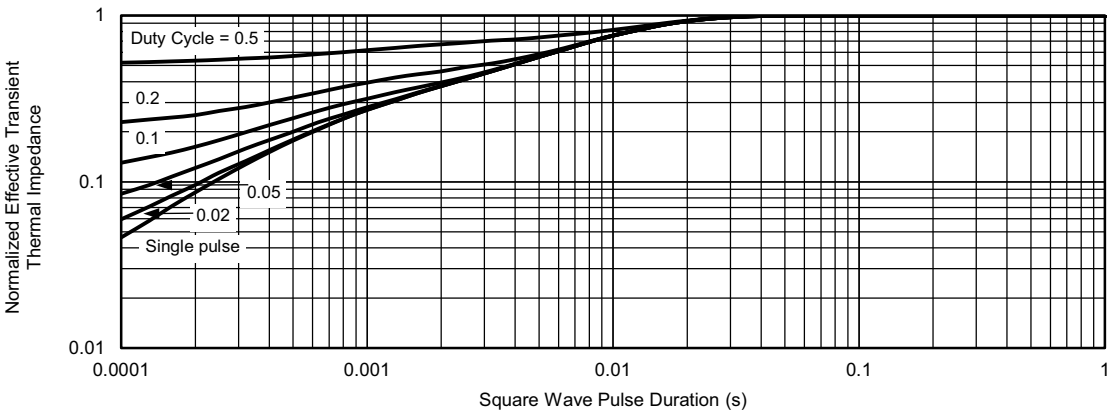
Current Derating [a]

Note

a. 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



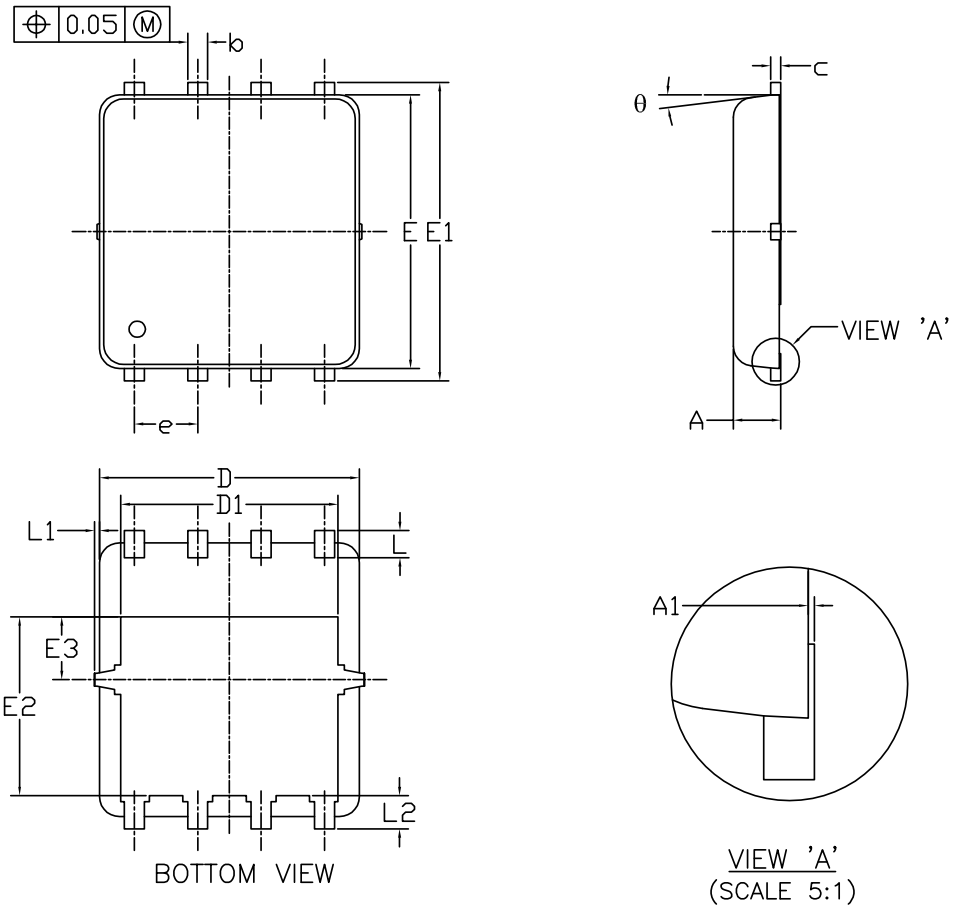
Normalized Thermal Transient Impedance, Junction-to-Ambient



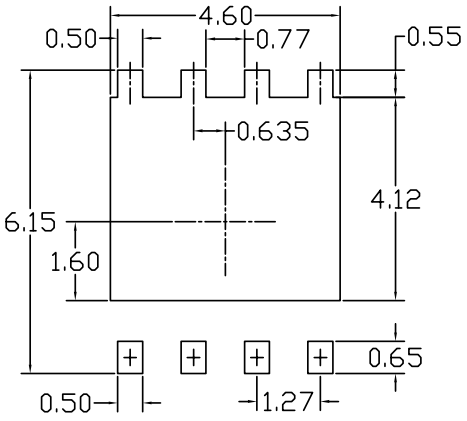
Normalized Thermal Transient Impedance, Junction-to-Foot

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package / tape drawings, part marking, and reliability data, see www.vishay.com/ppg?75480.

DFN5x6_8L_EP1_P PACKAGE OUTLIN



RECOMMENDED LAND PATTERN



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	0.95	1.00	0.033	0.037	0.039
A1	0.00	---	0.05	0.000	---	0.002
b	0.30	0.40	0.50	0.012	0.016	0.020
c	0.15	0.20	0.25	0.006	0.008	0.010
D	5.10	5.20	5.30	0.201	0.205	0.209
D1	4.25	4.35	4.45	0.167	0.171	0.175
E	5.45	5.55	5.65	0.215	0.219	0.222
E1	5.95	6.05	6.15	0.234	0.238	0.242
E2	3.525	3.625	3.725	0.139	0.143	0.147
E3	1.175	1.275	1.375	0.046	0.050	0.054
e	1.27 BSC			0.050 BSC		
L	0.45	0.55	0.65	0.018	0.022	0.026
L1	0	---	0.15	0	---	0.006
L2	0.68 REF			0.027 REF		
θ	0°	---	10°	0°	---	10°

UNIT: mm

NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
   MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
2. CONTROLLING DIMENSION IS MILLIMETER.
   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT