

P-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A)	Q _g (Typ.)
- 20	0.048 at V _{GS} = - 4.5 V	- 6.5	14
	0.063 at V _{GS} = - 2.5 V	- 5.7	

FEATURES

- TrenchFET[®] Power MOSFET
- MICRO FOOT[®] Chipscale Packaging
Reduces Footprint Area Profile (0.62 mm) and On-Resistance Per Footprint Area

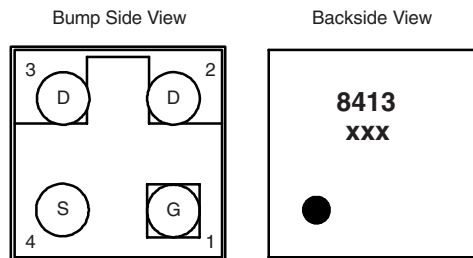


RoHS
COMPLIANT

APPLICATIONS

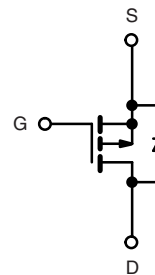
- Load Switch
- Battery Switch
- Charger Switch
- PA Switch

MICRO FOOT



Device Marking: 8413
xxx = Date/Lot Traceability Code

Ordering Information: Si8413DB-T1-E1 (Lead (Pb)-free)



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted				
Parameter	Symbol	5 s	Steady State	Unit
Drain-Source Voltage	V _{DS}	- 20		V
Gate-Source Voltage	V _{GS}	± 12		
Continuous Drain Current (T _J = 150 °C) ^a	I _D	T _A = 25 °C	- 6.5	- 4.8
		T _A = 70 °C	- 5.2	- 3.8
Pulsed Drain Current	I _{DM}	- 25		A
Continuous Source Current (Diode Conduction) ^a	I _S	- 2.5	- 1.3	
Maximum Power Dissipation ^a	P _D	T _A = 25 °C	2.77	1.47
		T _A = 70 °C	1.77	0.94
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 150		°C
Package Reflow Conditions ^b	IR/Convection	260		

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^a	t ≤ 5 s	R _{thJA}	35	45	°C/W
	Steady State		72	85	
Maximum Junction-to-Foot (Drain)	Steady State	R _{thJF}	16	20	

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

b. Refer to IPC/JEDEC (J-STD-020C), no manual or hand soldering.



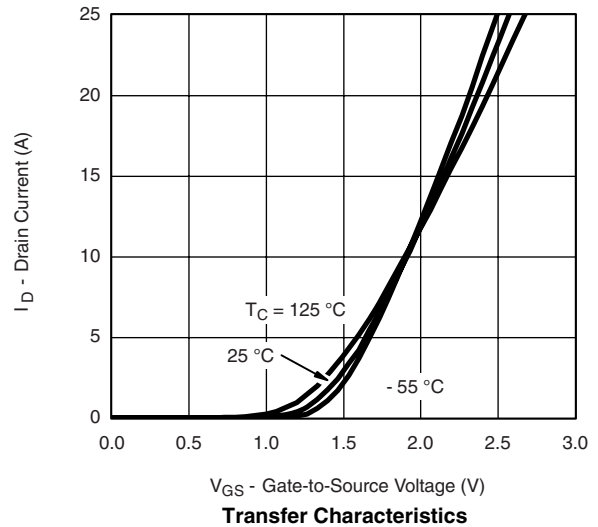
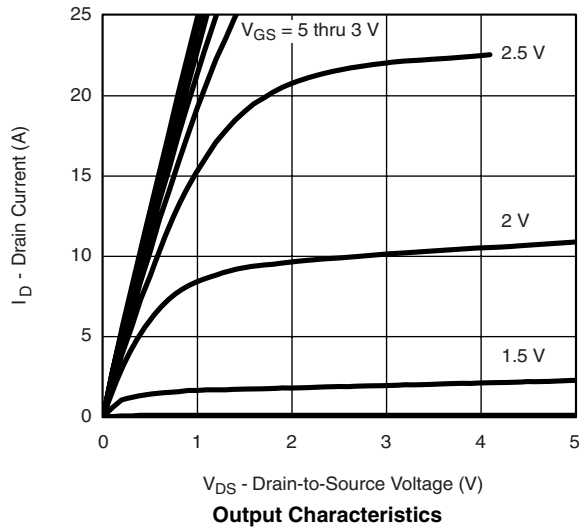
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-0.6		-1.4	V
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ }^\circ\text{C}$			-5	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	-5			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -1\text{ A}$		0.0393	0.048	Ω
		$V_{GS} = -2.5\text{ V}, I_D = -1\text{ A}$		0.052	0.063	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -10\text{ V}, I_D = -1\text{ A}$		7.4		S
Diode Forward Voltage ^a	V_{SD}	$I_S = -1\text{ A}, V_{GS} = 0\text{ V}$		-0.8	-1.1	V
Dynamic^b						
Total Gate Charge	Q_g	$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -1\text{ A}$		14	21	nC
Gate-Source Charge	Q_{gs}		1.7			
Gate-Drain Charge	Q_{gd}		5.1			
Gate Resistance	R_g			18		Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 10\text{ }\Omega$ $I_D \cong -1\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 6\text{ }\Omega$		31	50	ns
Rise Time	t_r		50	75		
Turn-Off Delay Time	$t_{d(off)}$		105	160		
Fall Time	t_f		90	135		
Source-Drain Reverse Recovery Time	t_{rr}	$I_F = -1\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$		85	130	

Notes:

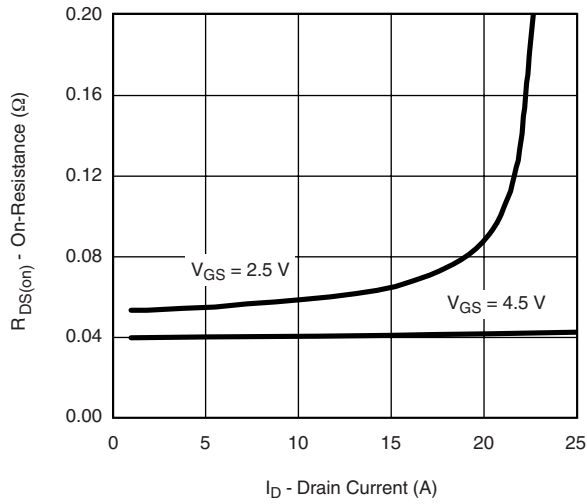
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- b. Guaranteed by design, not subject to production testing.

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.

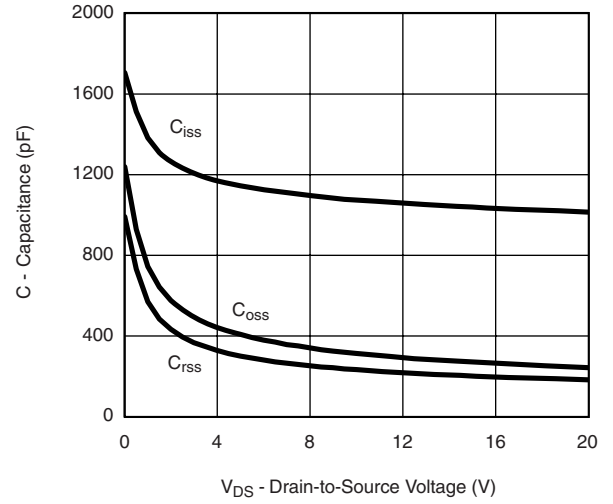
TYPICAL CHARACTERISTICS $25\text{ }^\circ\text{C}$, unless otherwise noted



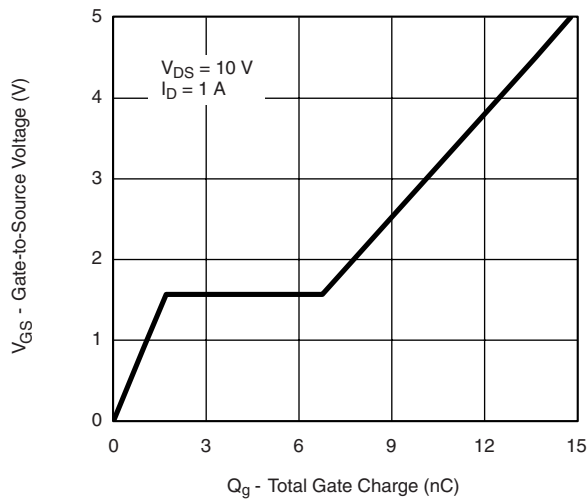
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



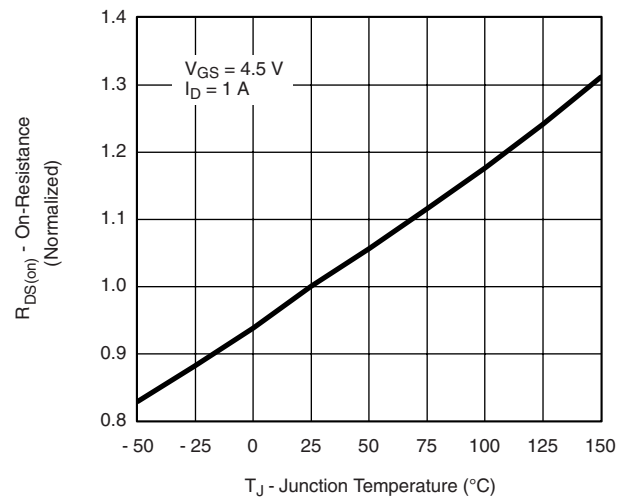
On-Resistance vs. Drain Current



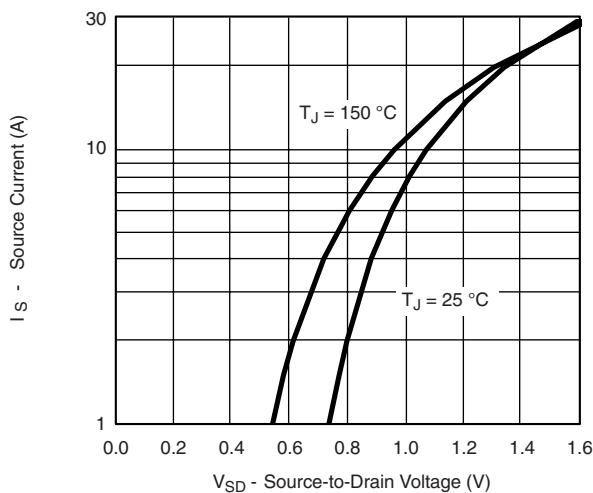
Capacitance



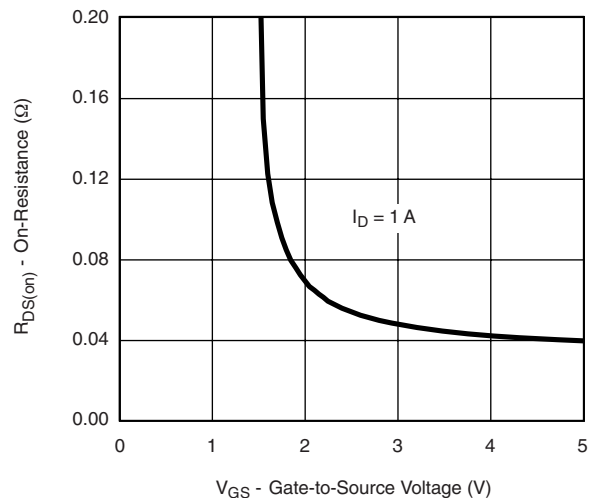
Gate Charge



On-Resistance vs. Junction Temperature

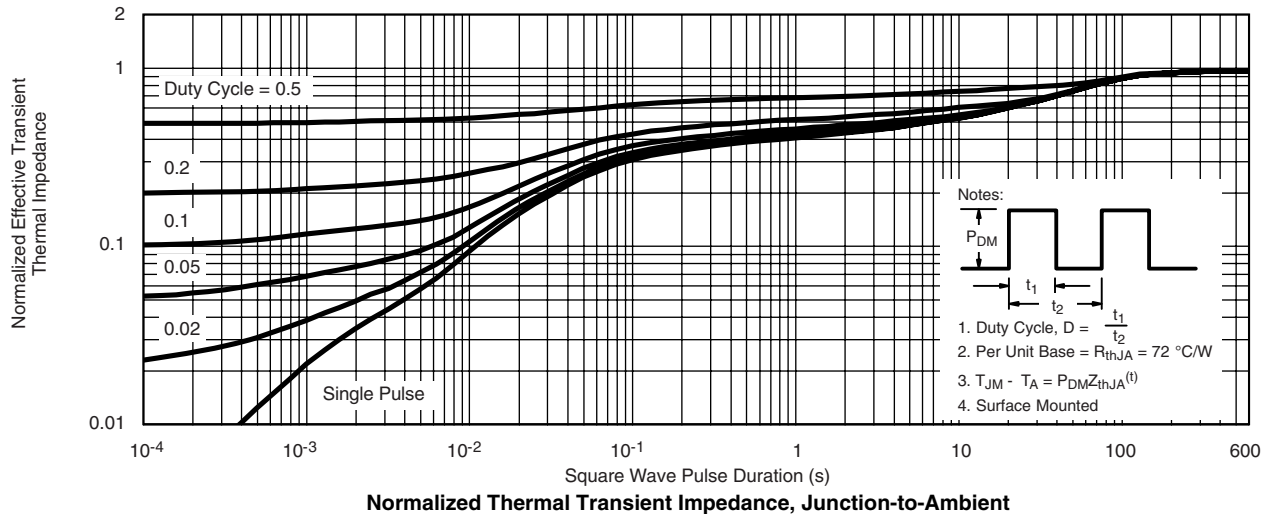
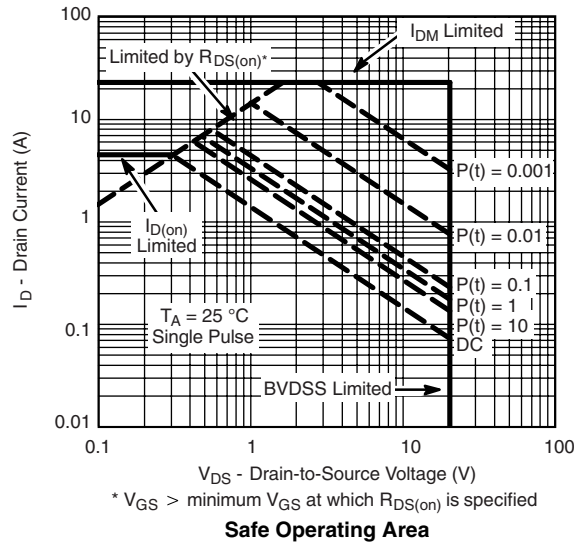
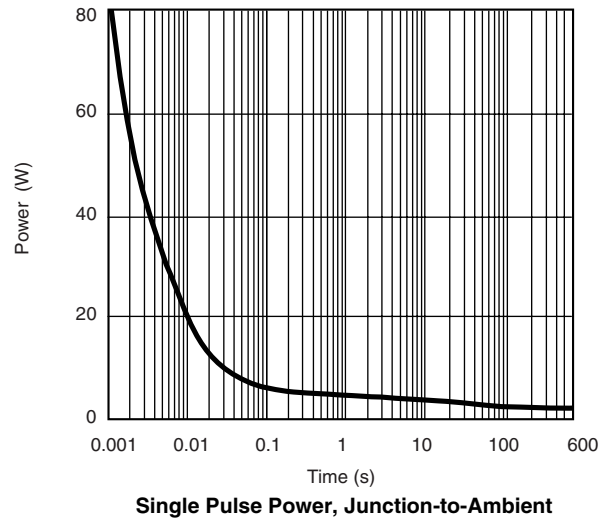
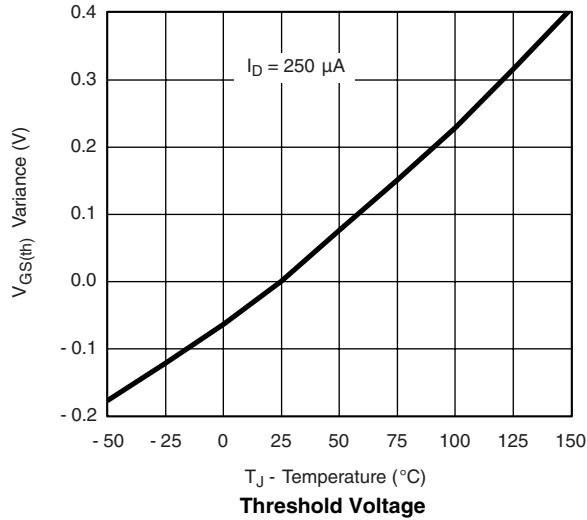


Source-Drain Diode Forward Voltage



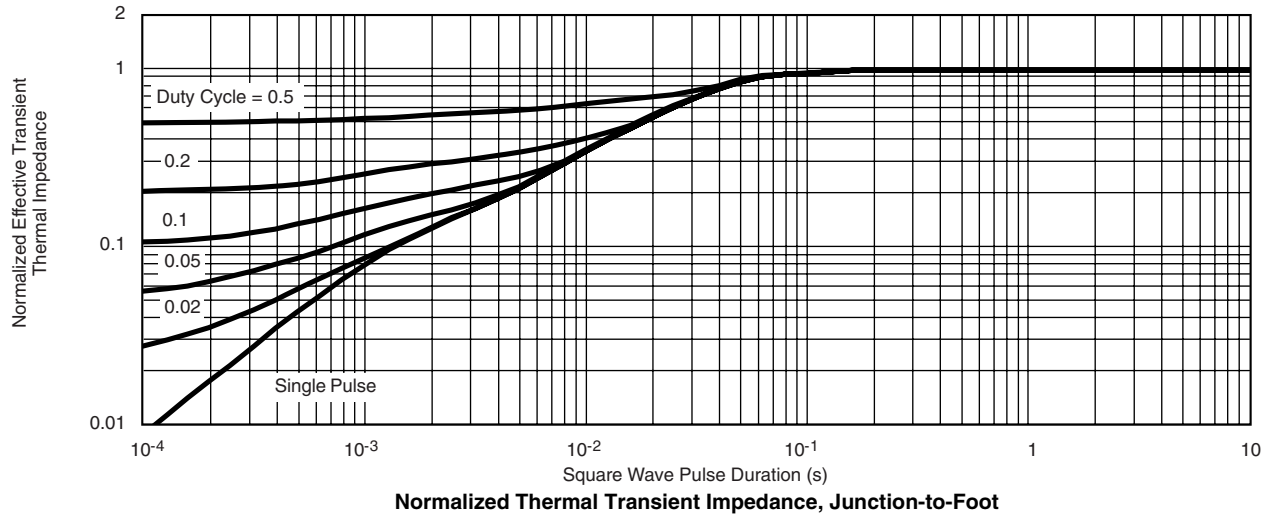
On-Resistance vs. Gate-to-Source Voltage

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



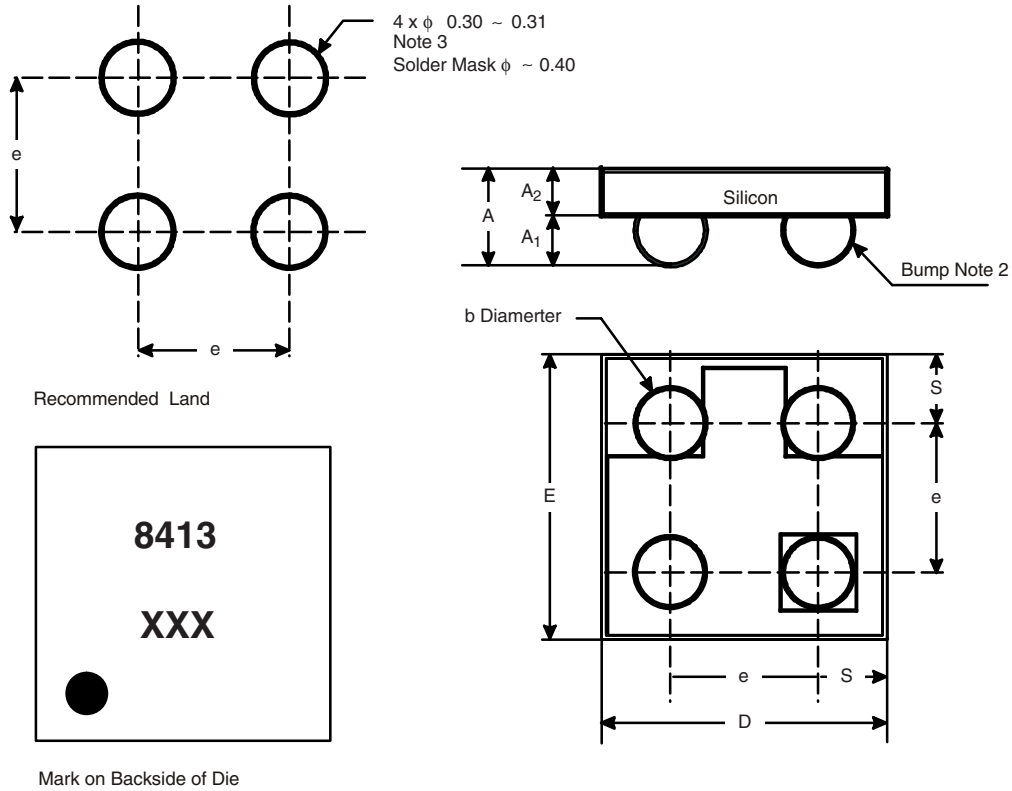


TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



PACKAGE OUTLINE

MICRO FOOT: 4-BUMP (2 x 2, 0.8 mm PITCH)



Notes (Unless Otherwise Specified):

1. Laser mark on the silicon die back, coated with a thin metal.
2. Bumps are 95.5/3.8/0.7 Sn/Ag/Cu.
3. Non-solder mask defined copper landing pad.
4. The flat side of wafers is oriented at the bottom.

DIMENSIONS	Millimeters ^a		Inches	
	MIN.	MAX.	MIN.	MAX.
A	0.600	0.650	0.0236	0.0256
A ₁	0.260	0.290	0.0102	0.0114
A ₂	0.340	0.360	0.0134	0.0142
b	0.370	0.410	0.0146	0.0161
D	1.520	1.600	0.0598	0.0630
E	1.520	1.600	0.0598	0.0630
e	0.750	0.850	0.0295	0.0335
S	0.370	0.380	0.0146	0.0150

Notes:

- a. Use millimeters as the primary measurement.

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