

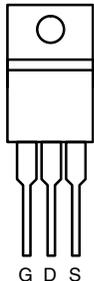
## P-Channel 40 V (D-S) 175 °C MOSFET

### PRODUCT SUMMARY

V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
- 40	0.015 at V <sub>GS</sub> = - 10 V	- 65
	0.023 at V <sub>GS</sub> = - 4.5 V	- 50

### FEATURES

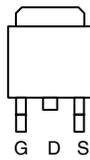
- TrenchFET<sup>®</sup> Power MOSFET
- Compliant to RoHS Directive 2002/95/EC


**RoHS**  
COMPLIANT


Top View

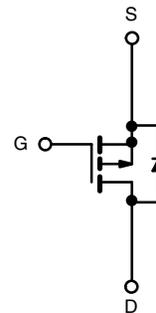
SUP65P04-15

DRAIN connected to TAB

**TO-263**


Top View

SUB65P04-15



P-Channel MOSFET

**Ordering Information:** SUP65P04-15-E3 (Lead (Pb)-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> = 175 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 65
		T <sub>C</sub> = 125 °C	- 37
Pulsed Drain Current	I <sub>DM</sub>	- 240	A
Avalanche Current	I <sub>AR</sub>	- 60	
Repetitive Avalanche Energy <sup>a</sup>	E <sub>AR</sub>	180	mJ
Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C (TO-220AB and TO-263)	120 <sup>c</sup>
		T <sub>A</sub> = 25 °C (TO-263) <sup>b</sup>	3.75
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175	°C

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient	PCB Mount (TO-263) <sup>b</sup>	R <sub>thJA</sub>	40
	Free Air (TO-220AB)	R <sub>thJA</sub>	62.5
Junction-to-Case	R <sub>thJC</sub>	1.25	°C/W

Notes:

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

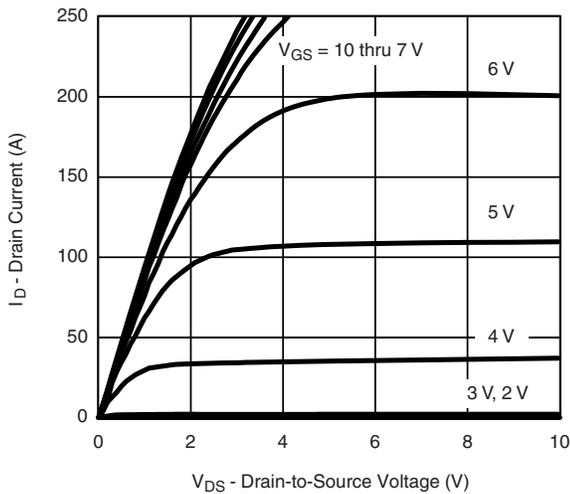
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 40			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	- 1		- 3	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	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	
		$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$			- 250	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	- 120			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -30\text{ A}$		0.012	0.015	$\Omega$
		$V_{GS} = -10\text{ V}, I_D = -30\text{ A}, T_J = 125\text{ }^\circ\text{C}$			0.024	
		$V_{GS} = -10\text{ V}, I_D = -30\text{ A}, T_J = 175\text{ }^\circ\text{C}$			0.030	
		$V_{GS} = -4.5\text{ V}, I_D = -20\text{ A}$		0.018	0.023	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -50\text{ A}$	20			S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1\text{ MHz}$		5400		$\text{pF}$
Output Capacitance	$C_{oss}$			640		
Reverse Transfer Capacitance	$C_{rss}$			300		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = -20\text{ V}, V_{GS} = -10\text{ V}, I_D = -65\text{ A}$		85	130	$\text{nC}$
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			25		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			15		
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = -20\text{ V}, R_L = 0.3\text{ }\Omega$ $I_D \cong -65\text{ A}, V_{GEN} = -10\text{ V}, R_G = 2.5\text{ }\Omega$		15	25	$\text{ns}$
Rise Time <sup>c</sup>	$t_r$			380	580	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			75	115	
Fall Time <sup>c</sup>	$t_f$			140	210	
<b>Source-Drain Diode Ratings and Characteristics</b> ( $T_C = 25\text{ }^\circ\text{C}$ ) <sup>b</sup>						
Continuous Current	$I_S$				- 65	A
Pulsed Current	$I_{SM}$				- 240	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = -65\text{ A}, V_{GS} = 0\text{ V}$		- 1.2	- 1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = -65\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$		40	80	ns
Peak Reverse Recovery Charge	$I_{RM(REC)}$			2	4	A
Reverse Recovery Charge	$Q_{rr}$			0.04	0.1	$\mu\text{C}$

Notes:

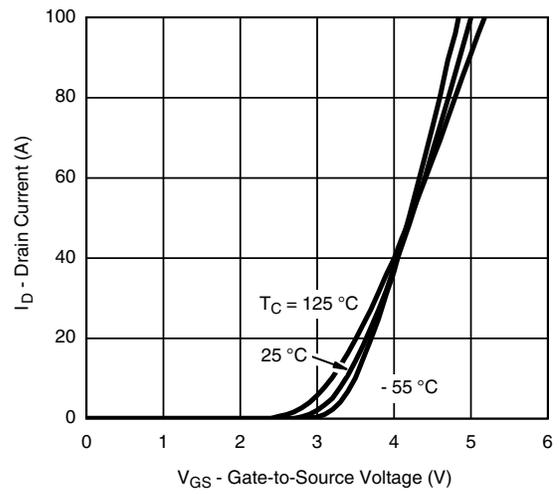
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

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.

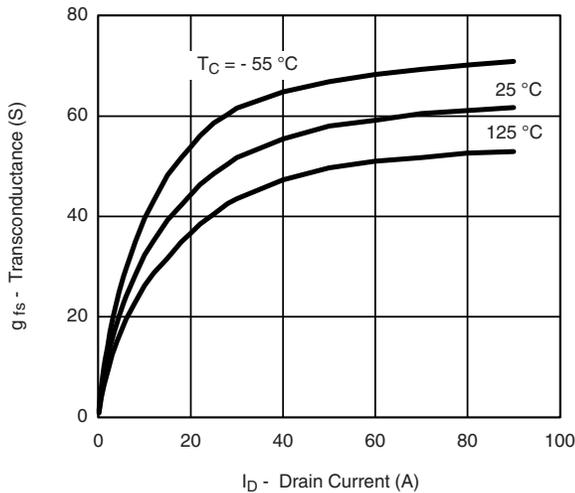
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



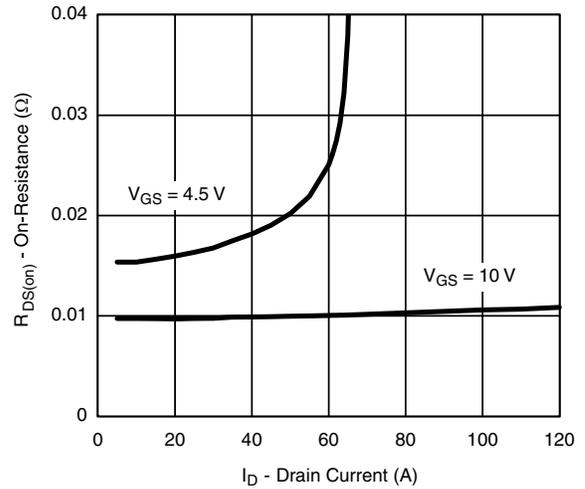
**Output Characteristics**



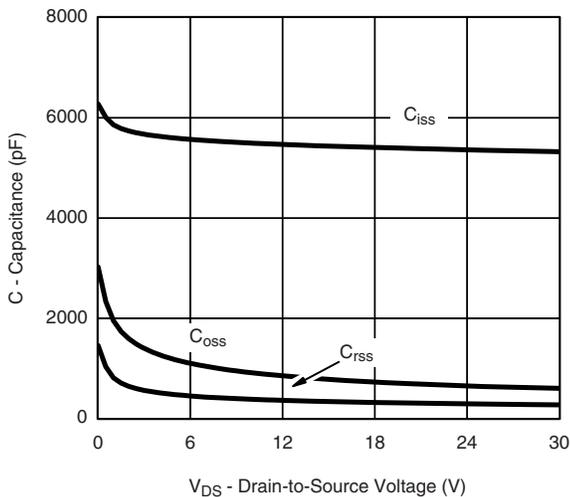
**Transfer Characteristics**



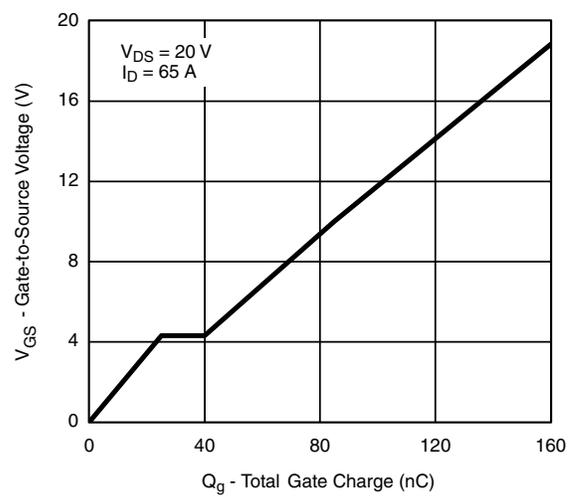
**Transconductance**



**On-Resistance vs. Drain Current**

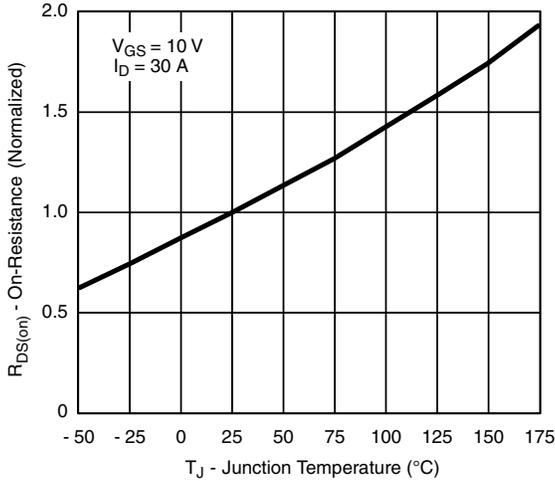


**Capacitance**

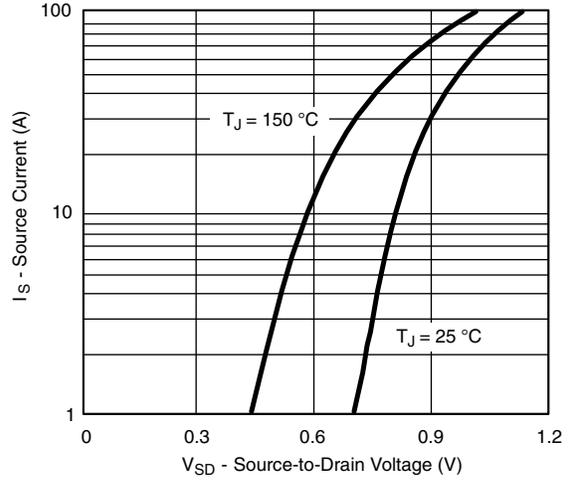


**Gate Charge**

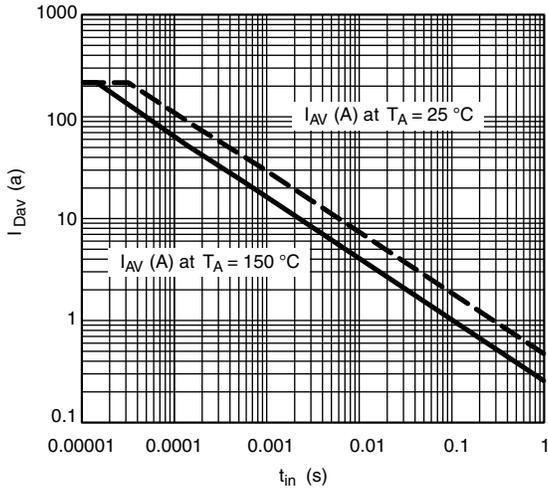
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



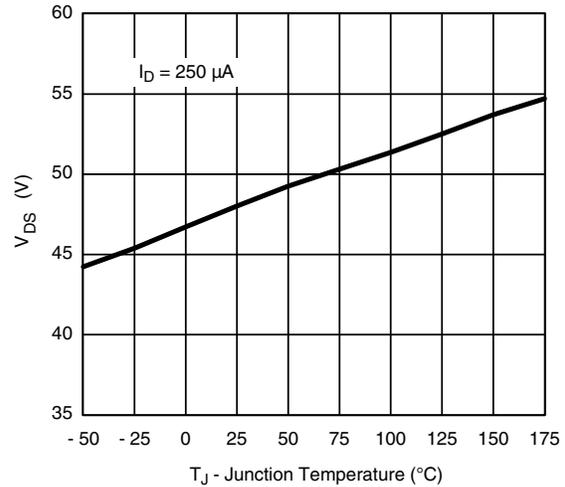
**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**

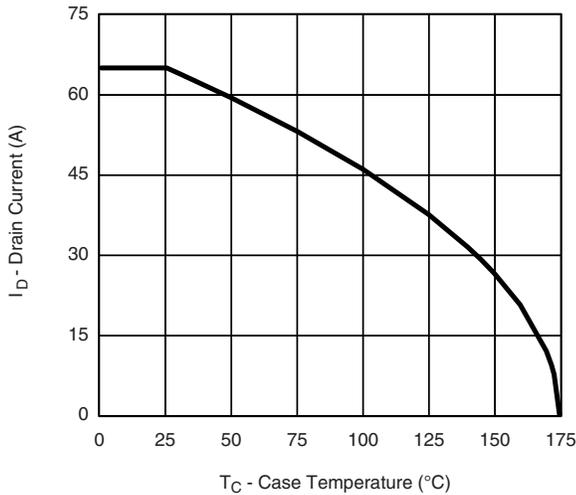


**Avalanche Current vs. Time**

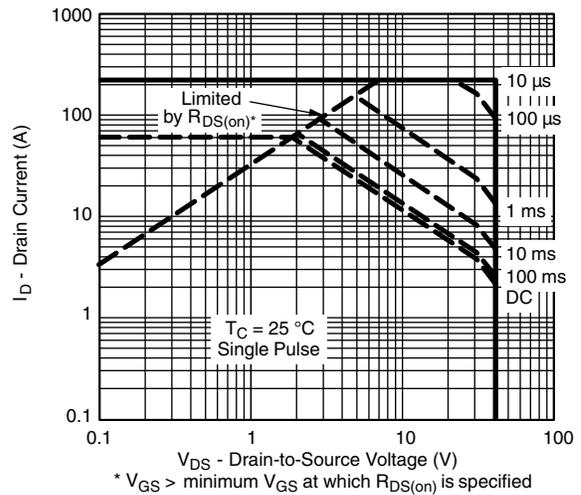


**Drain Source Breakdown vs. Junction Temperature**

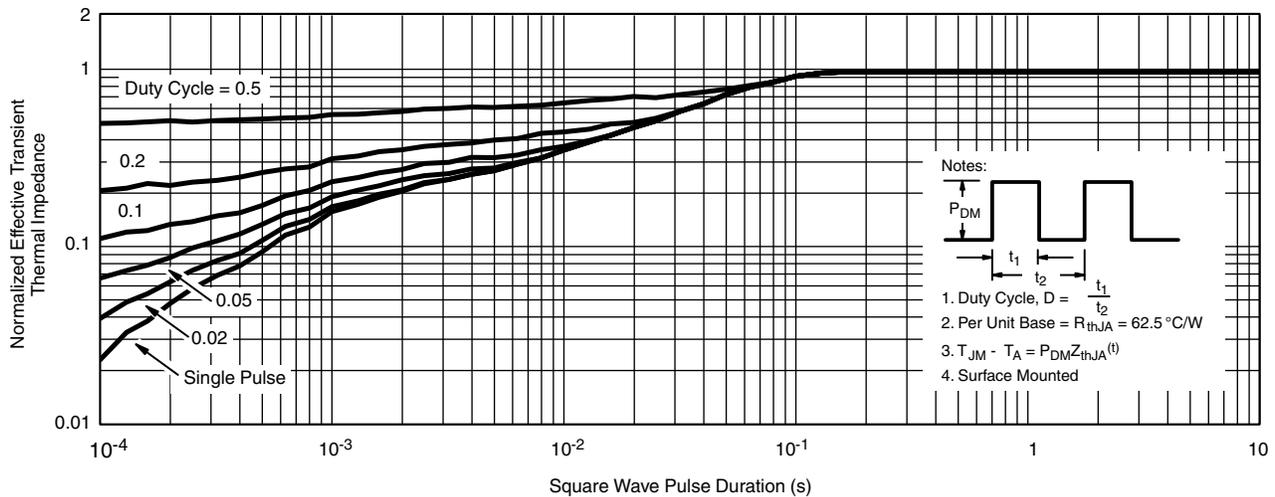
**THERMAL RATINGS**



**Maximum Avalanche and Drain Current vs. Case Temperature**



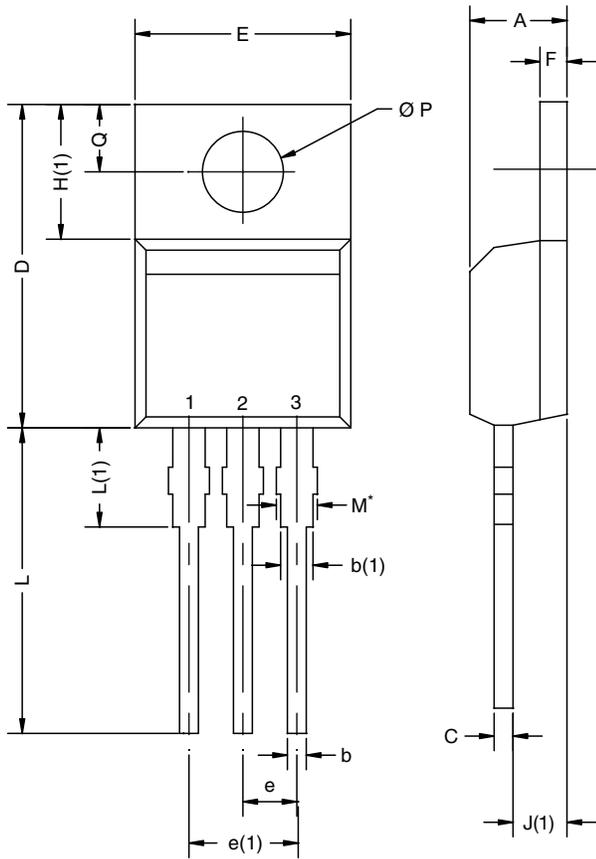
**Safe Operating Area**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



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

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## TO-220AB

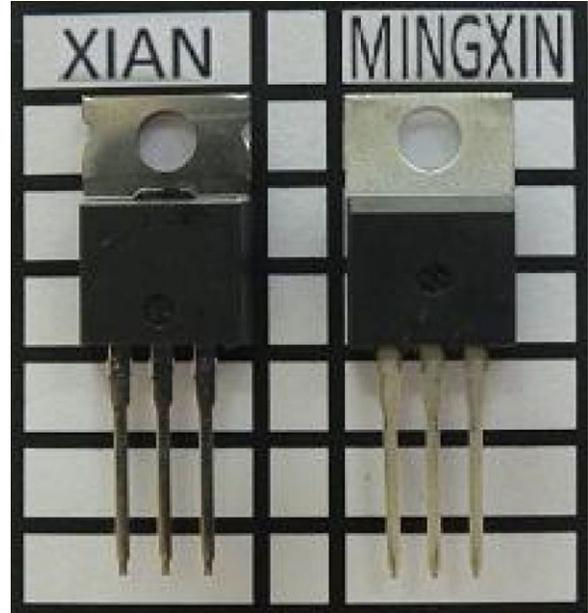


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12  
DWG: 5471

**Notes**

- \* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM
- Xi'an and Mingxin actual photo





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