

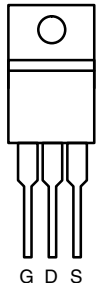
P-Channel 40 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY

V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A)
- 40	0.015 at V _{GS} = - 10 V	- 65
	0.023 at V _{GS} = - 4.5 V	- 50

FEATURES

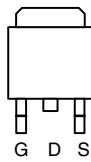
- TrenchFET[®] Power MOSFET
- Compliant to RoHS Directive 2002/95/EC


RoHS
COMPLIANT


Top View

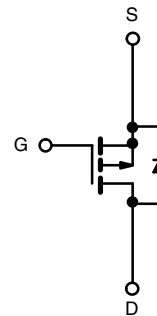
SUP65P04-15

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_C = 25 °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V _{DS}	- 40	V
Gate-Source Voltage	V _{GS}	± 20	
Continuous Drain Current (T _J = 175 °C)	I _D	T _C = 25 °C	- 65
		T _C = 125 °C	- 37
Pulsed Drain Current	I _{DM}	- 240	A
Avalanche Current	I _{AR}	- 60	
Repetitive Avalanche Energy ^a	E _{AR}	180	mJ
Power Dissipation	P _D	T _C = 25 °C (TO-220AB and TO-263)	120 ^c
		T _A = 25 °C (TO-263) ^b	3.75
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 175	°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient	PCB Mount (TO-263) ^b	R _{thJA}	40
	Free Air (TO-220AB)	R _{thJA}	62.5
Junction-to-Case	R _{thJC}	1.25	°C/W

Notes:

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

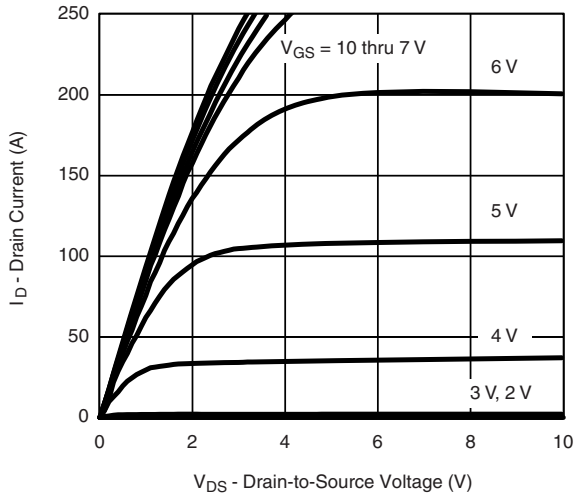
SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 40			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D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

Notes:

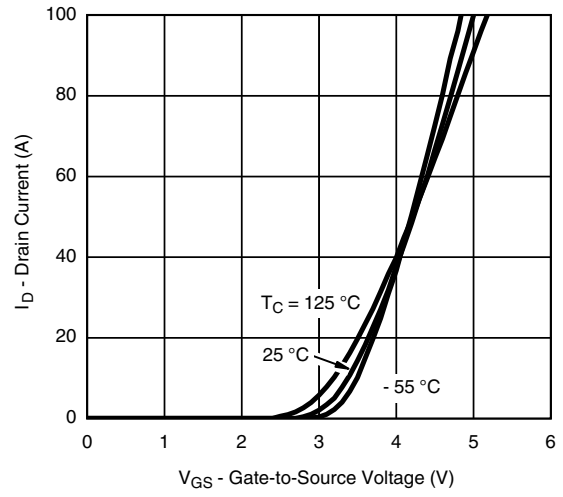
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

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.

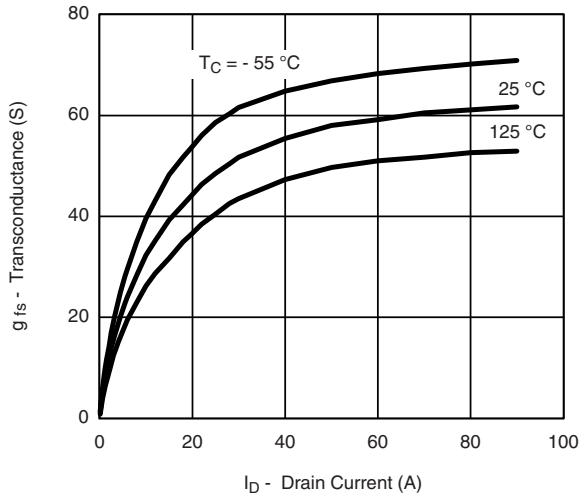
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



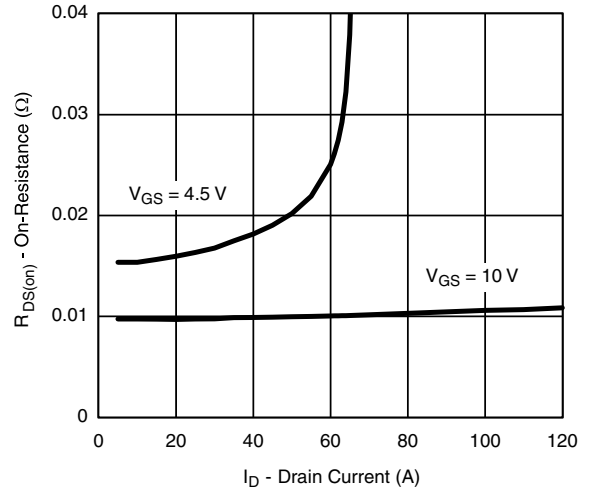
Output Characteristics



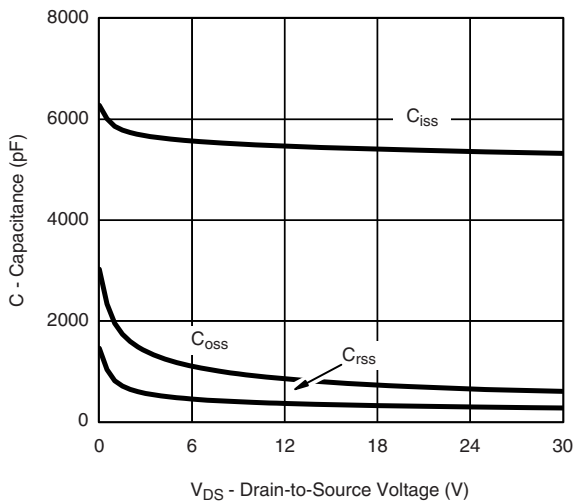
Transfer Characteristics



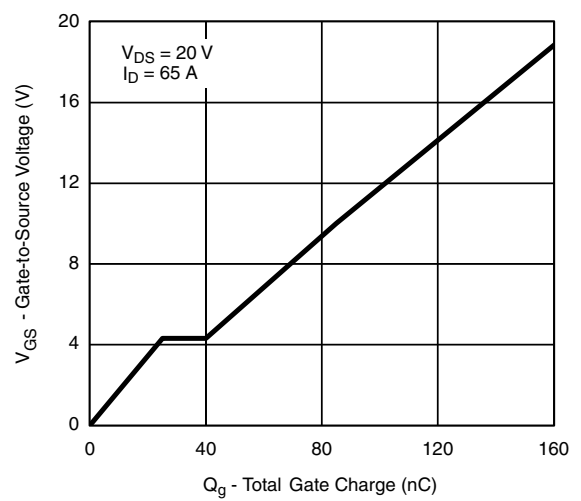
Transconductance



On-Resistance vs. Drain Current

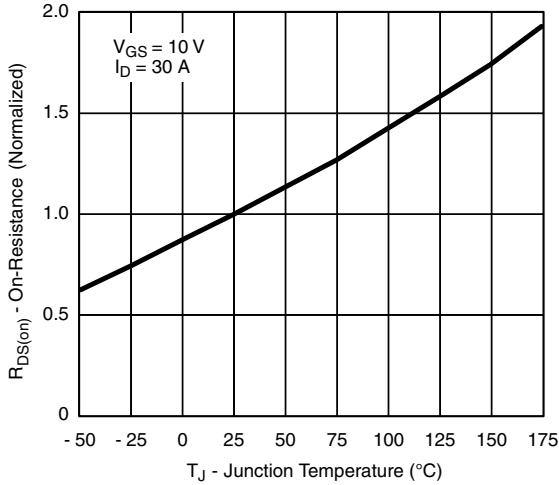


Capacitance

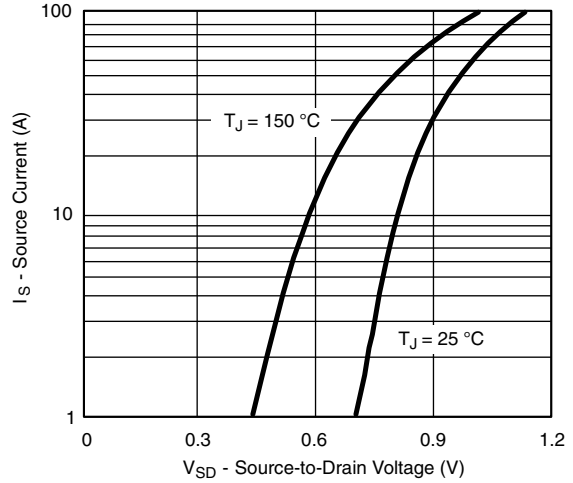


Gate Charge

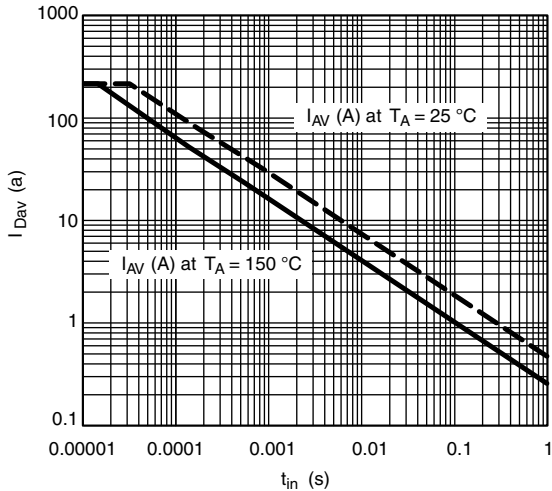
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



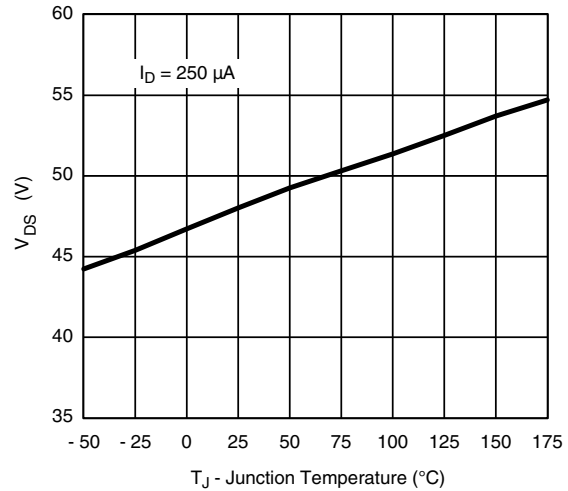
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

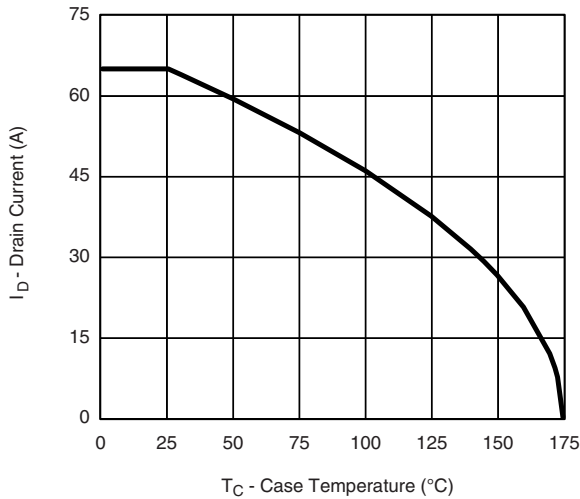


Avalanche Current vs. Time

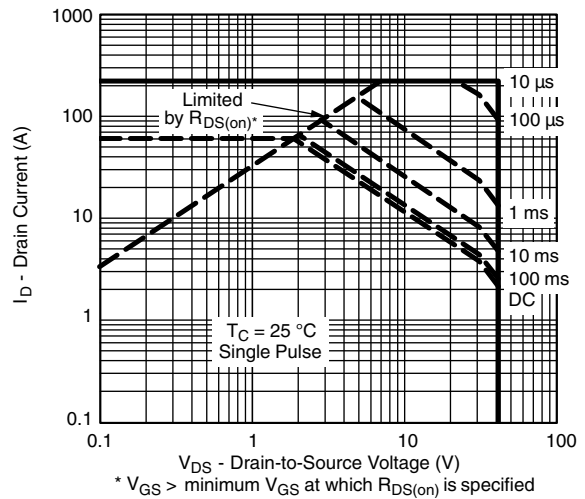


Drain Source Breakdown vs. Junction Temperature

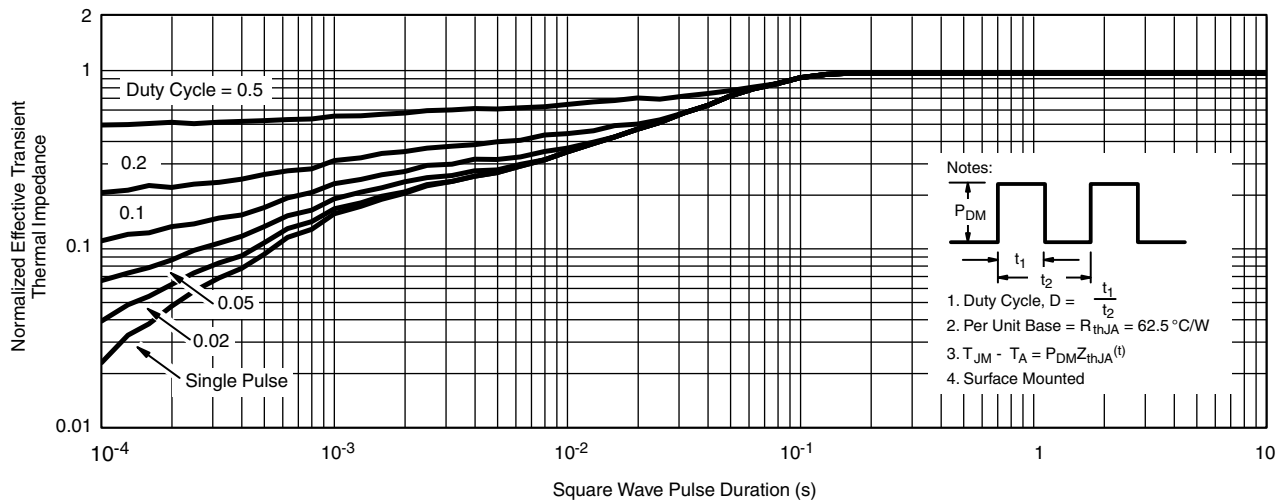
THERMAL RATINGS



Maximum Avalanche and Drain Current vs. Case Temperature



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

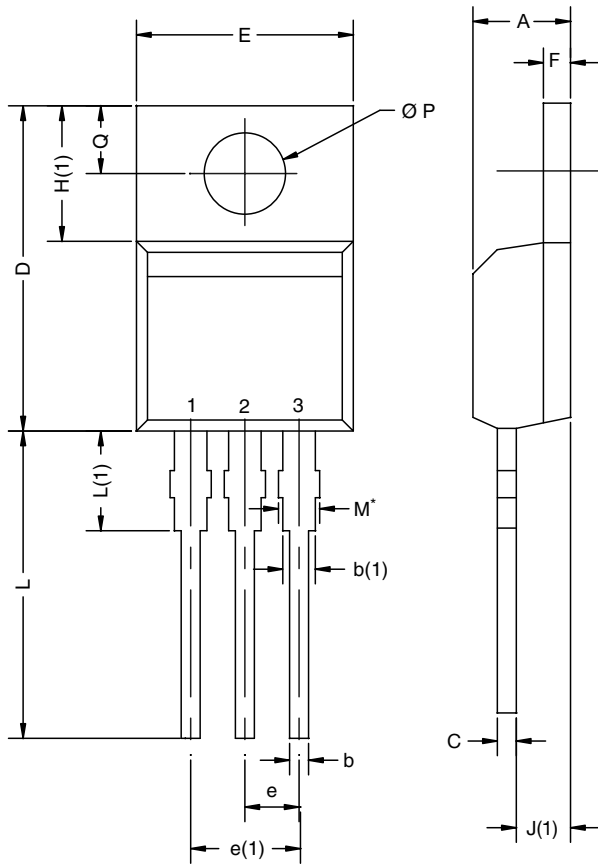


Normalized Thermal Transient Impedance, Junction-to-Case

- Notes:
1. Duty Cycle, $D = \frac{t_1}{t_2}$
 2. Per Unit Base = $R_{thJA} = 62.5^\circ\text{C/W}$
 3. $T_{JM} - T_A = P_{DM}Z_{thJA}^{(t)}$
 4. Surface Mounted

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TO-220AB

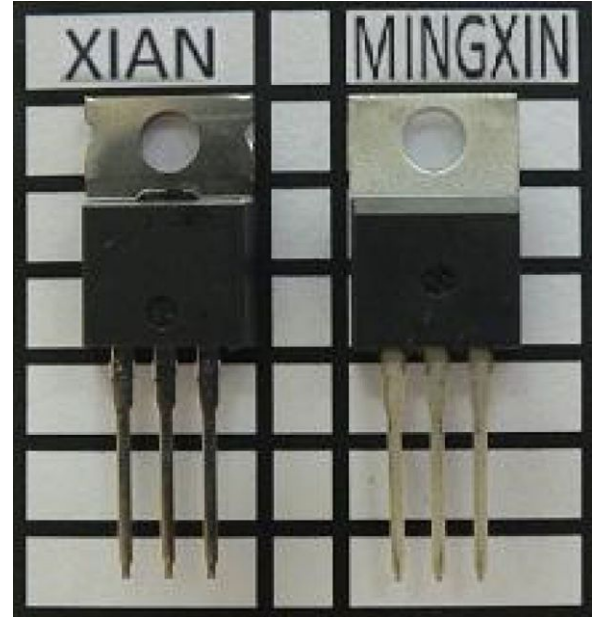


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	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
$\varnothing P$	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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