

Dual N-Channel 60-V (D-S) 175 °C MOSFET

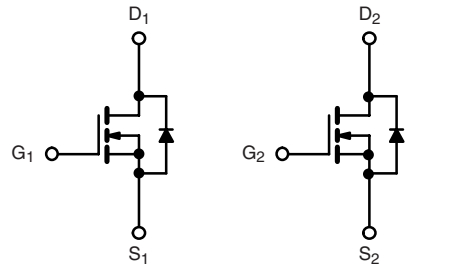
PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A)	Q _g (Typ.)
60	0.041 at V _{GS} = 10 V	6.5	9.2 nC
	0.052 at V _{GS} = 4.5 V	5.8	

FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 175 °C Maximum Junction Temperature
- 100 % R_g Tested
- Compliant to RoHS directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE
Available



N-Channel MOSFET

N-Channel MOSFET

Ordering Information: Si4946BEY-T1-E3 (Lead (Pb)-free)
Si4946BEY-T1-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)	I _D	T _C = 25 °C	6.5
		T _C = 70 °C	5.5
		T _A = 25 °C	5.3 ^{a, b}
		T _A = 70 °C	4.4 ^{a, b}
Pulsed Drain Current	I _{DM}	30	A
Continuous Source Drain Diode Current	I _S	T _C = 25 °C	
		T _A = 25 °C	2 ^{a, b}
Avalanche Current	I _{AS}	12	mJ
Single-Pulse Avalanche Energy	E _{AS}	7.2	
Maximum Power Dissipation	P _D	T _C = 25 °C	3.7
		T _C = 70 °C	2.6
		T _A = 25 °C	2.4 ^{a, b}
		T _A = 70 °C	1.7 ^{a, b}
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 175	°C

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient ^{a, c}	R _{thJA}	50	62.5	°C/W	
Maximum Junction-to-Foot (Drain)	R _{thJF}	33	41		

Notes:

- Surface Mounted on 1" x 1" FR4 board.
- t = 10 s.
- Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Maximum under Steady State conditions is 110 °C/W.

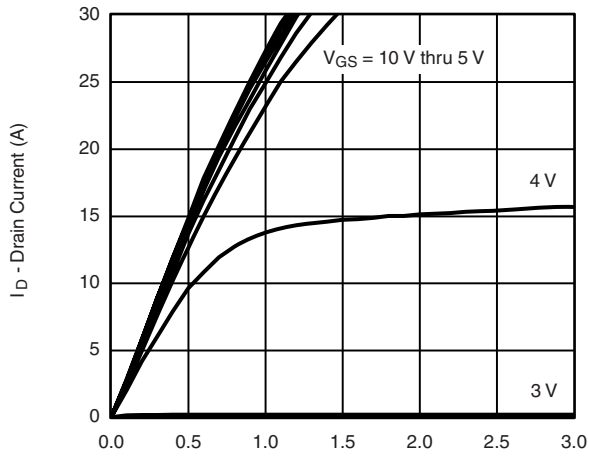
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		53		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 6.7		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0	2.4	3.0	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	30			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 5.3\text{ A}$		0.033	0.041	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 4.7\text{ A}$		0.041	0.052	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 5.3\text{ A}$		24		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		840		pF
Output Capacitance	C_{oss}			71		
Reverse Transfer Capacitance	C_{rss}			44		
Total Gate Charge	Q_g	$V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 5.3\text{ A}$		17	25	nC
		$V_{DS} = 30\text{ V}, V_{GS} = 5\text{ V}, I_D = 5.3\text{ A}$		9.2	12	
Gate-Source Charge	Q_{gs}			3.3		
Gate-Drain Charge	Q_{gd}			3.7		
Gate Resistance	R_g	$f = 1\text{ MHz}$	3.1	6.5	9.5	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 6.8\text{ }\Omega$ $I_D \cong 4.4\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		20	30	ns
Rise Time	t_r			120	180	
Turn-Off Delay Time	$t_{d(off)}$			20	30	
Fall Time	t_f			30	45	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 6.8\text{ }\Omega$ $I_D \cong 4.4\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		10	15	
Rise Time	t_r			12	20	
Turn-Off Delay Time	$t_{d(off)}$			25	40	
Fall Time	t_f			10	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			3.1	A
Pulse Diode Forward Current ^a	I_{SM}				30	
Body Diode Voltage	V_{SD}	$I_S = 2\text{ A}$		0.8	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 4.4\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		25	50	ns
Body Diode Reverse Recovery Charge	Q_{rr}			25	50	nC
Reverse Recovery Fall Time	t_a			18		ns
Reverse Recovery Rise Time	t_b			7		

Notes:

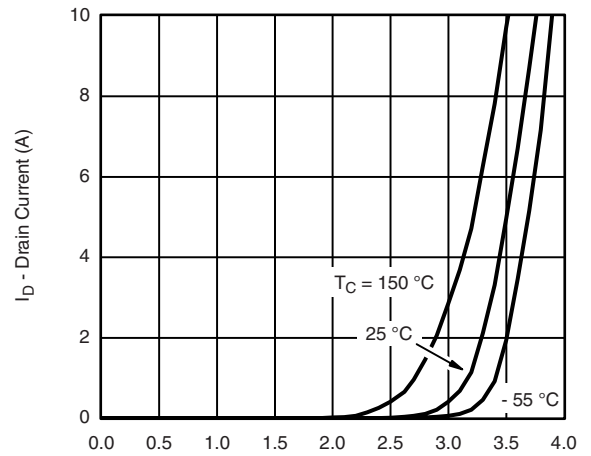
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.

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.

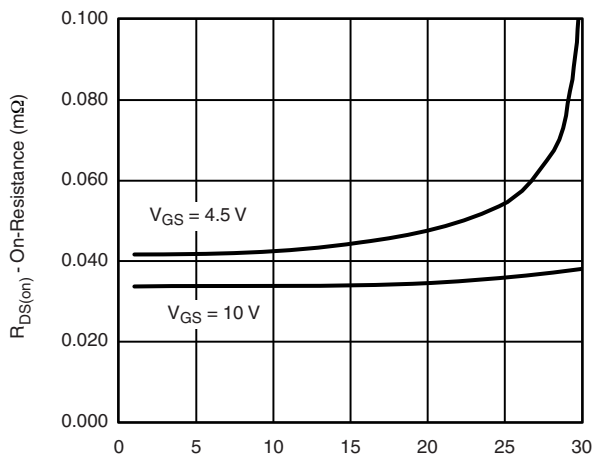
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



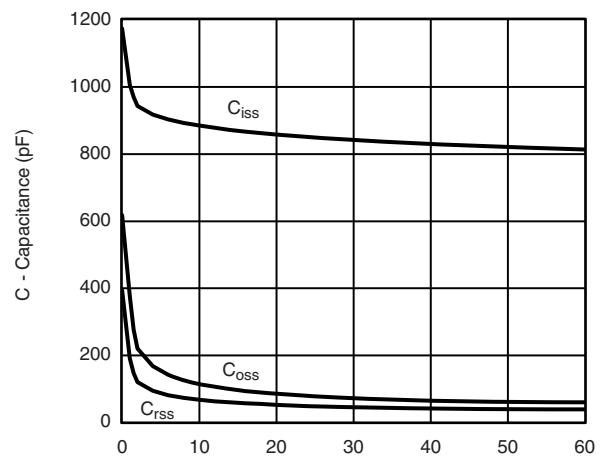
V_{DS} - Drain-to-Source Voltage (V)
Output Characteristics



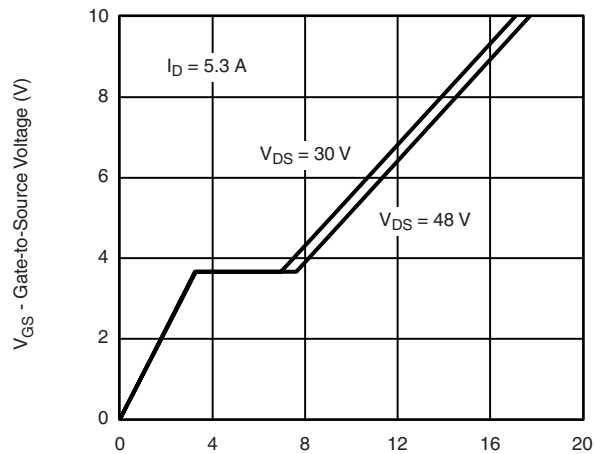
V_{GS} - Gate-to-Source Voltage (V)
Transfer Characteristics



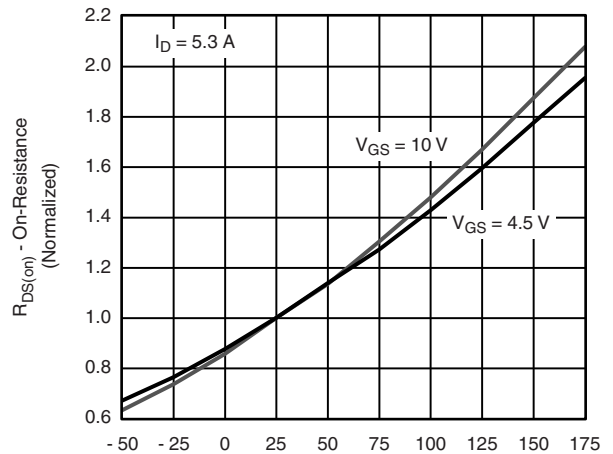
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



Q_g - Total Gate Charge (nC)
Gate Charge

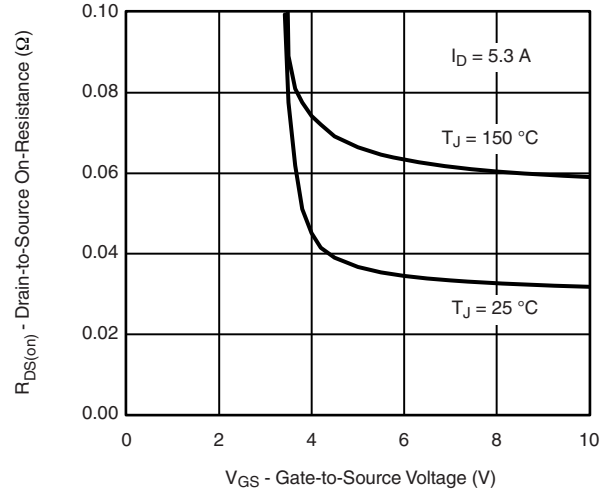


On-Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



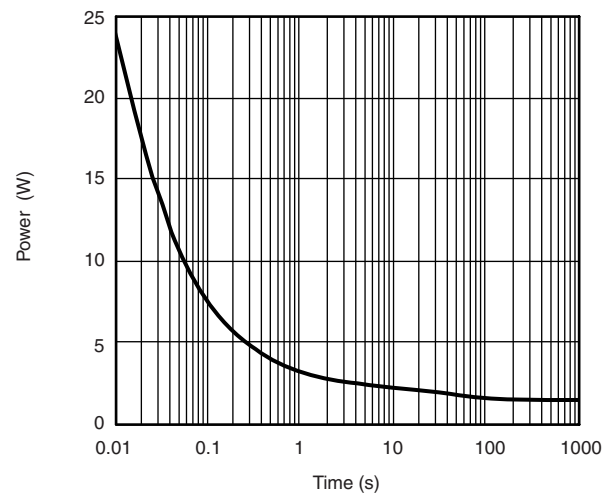
Source-Drain Diode Forward Voltage



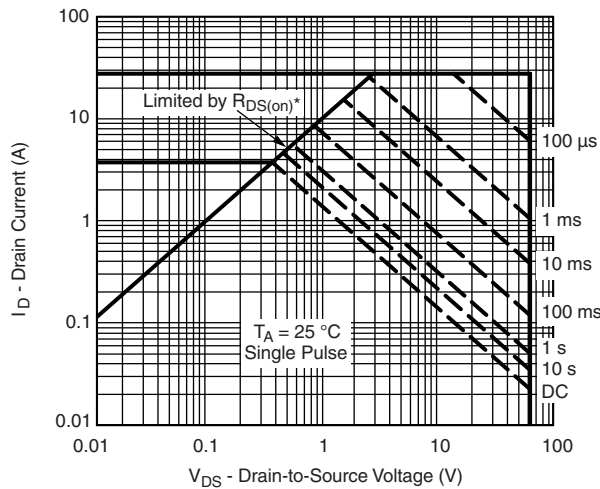
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



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

Safe Operating Area, Junction-to-Ambient

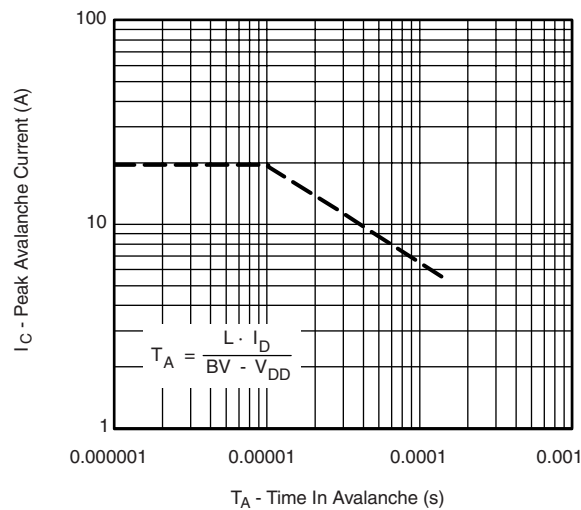
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



T_C - Case Temperature (°C)
Current Derating*



T_C - Case Temperature (°C)
Power, Junction-to-Case



Single Pulse Avalanche Capability

$$T_A = \frac{L \cdot I_D}{BV - V_{DD}}$$

* The power dissipation P_D is based on $T_{J(max)} = 175$ °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



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SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026
ECN: C-06527-Rev. I, 11-Sep-06				
DWG: 5498				

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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