

## Features

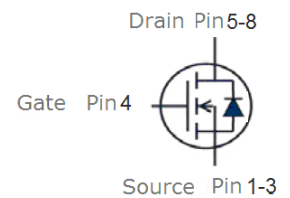
- N-Channel, 5V Logic Level Control
- Enhancement mode
- Very low on-resistance  $R_{DS(on)}$  @  $V_{GS}=4.5\text{ V}$
- Fast Switching
- Pb-free lead plating; RoHS compliant
- MSL: Level 1 compliant



$V_{DS}$	60	V
$R_{DS(on),TYP} @ V_{GS}=10\text{ V}$	9.5	m $\Omega$
$R_{DS(on),TYP} @ V_{GS}=4.5\text{ V}$	11.5	m $\Omega$
$I_D$	13	A



Part ID	Package Type	Marking	Tape and reel information
VSO012N06MS	SOP8	012N06M	3000pcs/Reel



## Maximum ratings, at $T_A=25\text{ }^\circ\text{C}$ , unless otherwise specified

Symbol	Parameter	Rating	Unit
$V_{(BR)DSS}$	Drain-Source breakdown voltage	60	V
$V_{GS}$	Gate-Source voltage	$\pm 20$	V
$I_S$	Continuous Source Current (Body Diode)	$T_A=25\text{ }^\circ\text{C}$	2.5 A
$I_{SM}$	Maximum Pulsed Current (Body Diode)	$T_A=25\text{ }^\circ\text{C}$	10 A
$I_D$	Continuous drain current @ $V_{GS}=10\text{ V}$	$T_A=25\text{ }^\circ\text{C}$	13 A
		$T_A=100\text{ }^\circ\text{C}$	8.3 A
$I_{DM}$	Pulse drain current tested ①	$T_A=25\text{ }^\circ\text{C}$	42 A
$I_{AS}$	Avalanche Current maximum	55	A
$E_{AS}$	Avalanche energy, single pulsed ②	1229	mJ
$P_D$	Maximum power dissipation	$T_A=25\text{ }^\circ\text{C}$	3 W
$T_{STG}, T_J$	Storage and Junction Temperature Range	-55 to 150	$^\circ\text{C}$

## Thermal Characteristics

Symbol	Parameter	Typical	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Lead	24	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	$^\circ\text{C/W}$

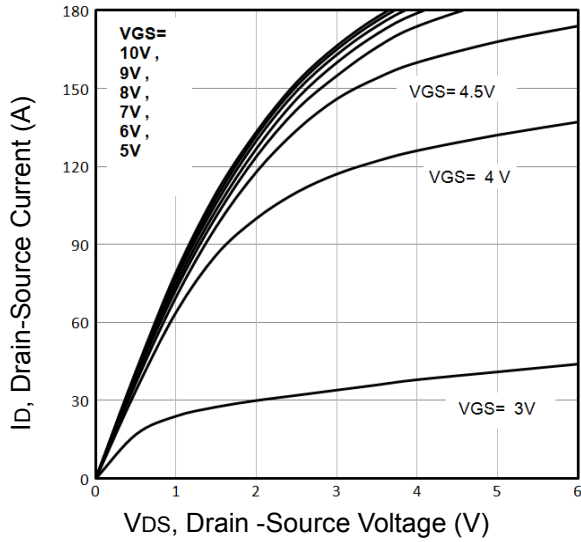
**Typical Characteristics**

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
<b>Static Electrical Characteristics @ T<sub>j</sub> = 25°C (unless otherwise stated)</b>						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	60	--	--	V
ΔV <sub>(BR)DSS</sub> / ΔT <sub>j</sub>	Breakdown voltage Temperature Coefficient	I <sub>D</sub> =250μA, Reference 25°C	--	0.052	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(T <sub>j</sub> =25°C)	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V	--	--	1	μA
	Zero Gate Voltage Drain Current(T <sub>j</sub> =125°C)	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V	--	--	100	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	--	--	±100	nA
V <sub>GS(TH)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.4	1.8	2.5	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance <sup>③</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =8A	--	9.5	12	mΩ
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance <sup>③</sup>	V <sub>GS</sub> =4.5V, I <sub>D</sub> =4A	--	11.5	14	mΩ
<b>Dynamic Electrical Characteristics @ T<sub>j</sub> = 25°C (unless otherwise stated)</b>						
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, f=1MHz	--	2.8	--	Ω
C <sub>iss</sub>	Input Capacitance		--	1905	--	pF
C <sub>oss</sub>	Output Capacitance		--	205	--	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	180	--	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =30V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V	--	26	--	nC
Q <sub>gs</sub>	Gate-Source Charge		--	6.5	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	4.5	--	nC
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =30V, I <sub>D</sub> =10A, R <sub>G</sub> =6.8Ω, V <sub>GS</sub> =10V	--	9	--	ns
t <sub>r</sub>	Turn-on Rise Time		--	5	--	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	28	--	ns
t <sub>f</sub>	Turn-Off Fall Time		--	4	--	ns
<b>Source- Drain Diode Characteristics @ T<sub>j</sub> = 25°C (unless otherwise stated)</b>						
V <sub>SD</sub>	Forward on voltage	I <sub>SD</sub> =2A, V <sub>GS</sub> =0V	--	0.71	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	T <sub>j</sub> =25 °C, I <sub>sd</sub> =10A, V <sub>GS</sub> =0V di/dt=100A/μs	--	23	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	52	--	nC

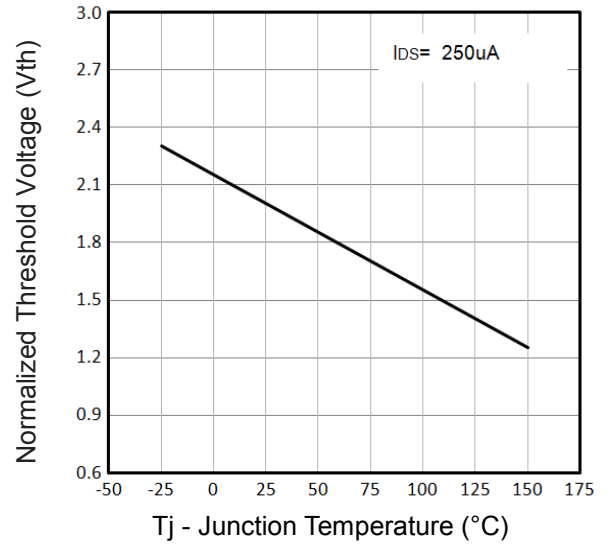
NOTE:

- ① Repetitive rating; pulse width limited by max junction temperature.
- ② Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.5mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 55A, V<sub>GS</sub> = 10V. Part not recommended for use above this value
- ③ Pulse width ≤ 300μs; duty cycle ≤ 2%.

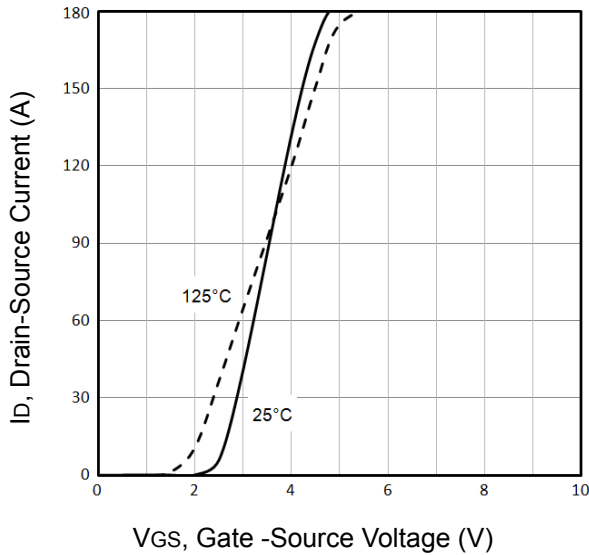
**Typical Characteristics**



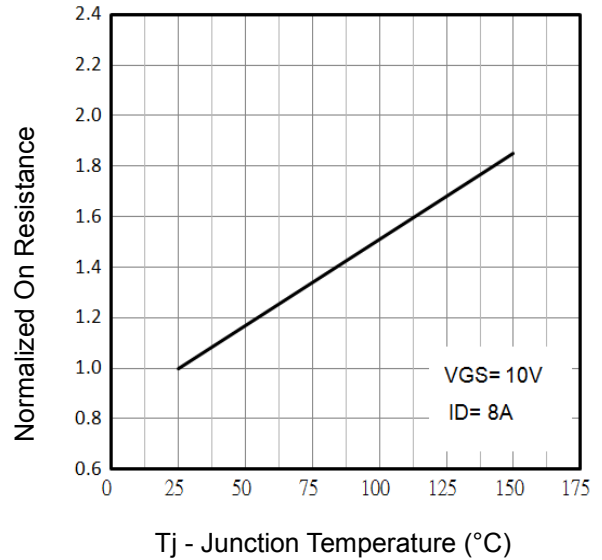
**Fig1.** Typical Output Characteristics



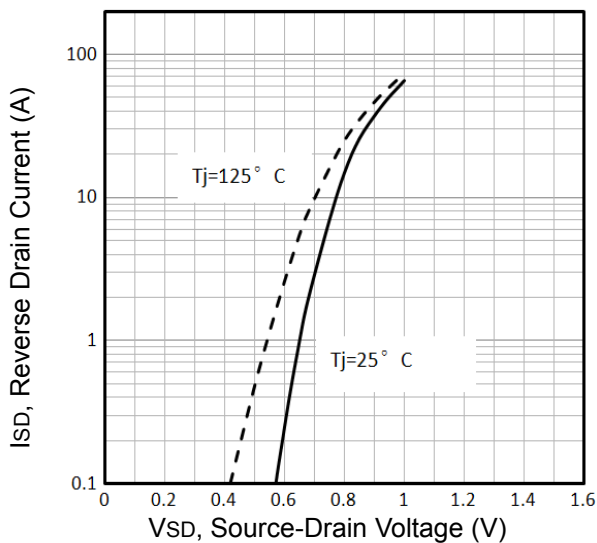
**Fig2.** Normalized Threshold Voltage Vs. Temperature



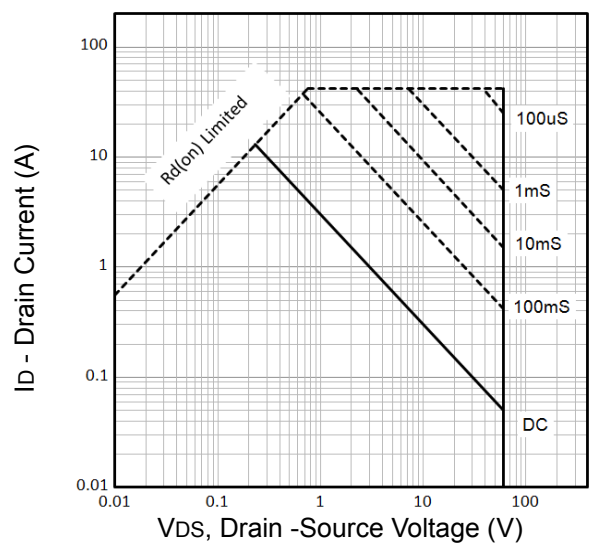
**Fig3.** Typical Transfer Characteristics



**Fig4.** Normalized On-Resistance Vs. Temperature



**Fig5.** Typical Source-Drain Diode Forward Voltage



**Fig6.** Maximum Safe Operating Area

Typical Characteristics

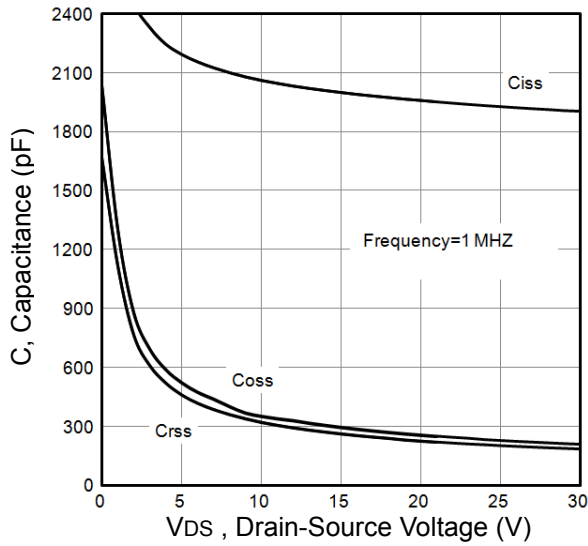


Fig7. Typical Capacitance Vs.Drain-Source Voltage

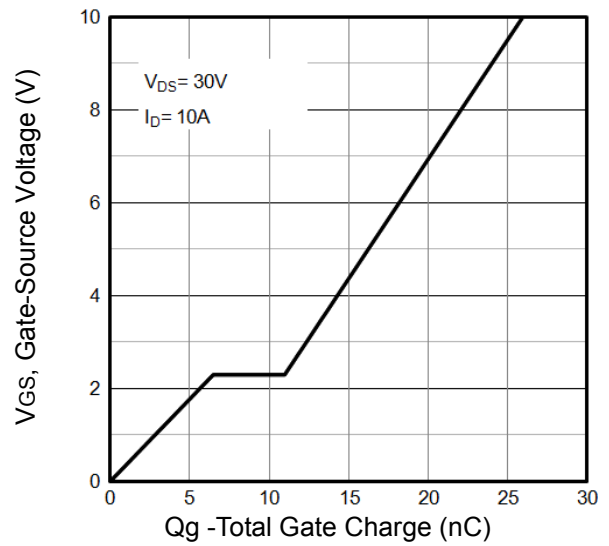


Fig8. Typical Gate Charge Vs.Gate-Source

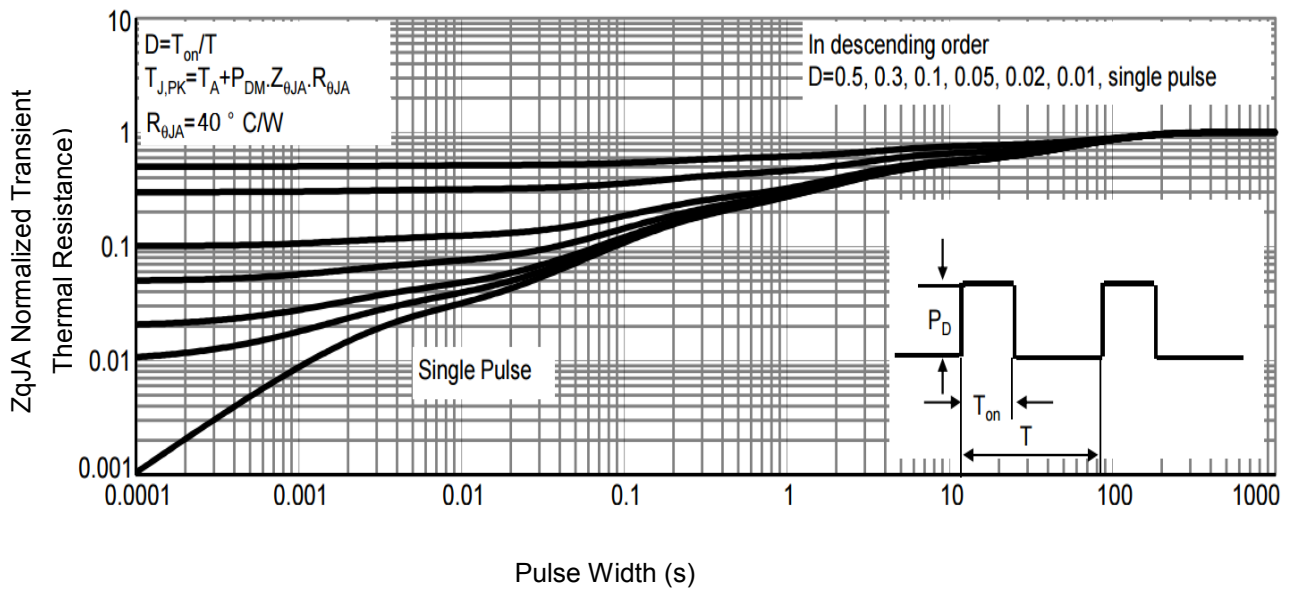


Fig9. Normalized Maximum Transient Thermal Impedance

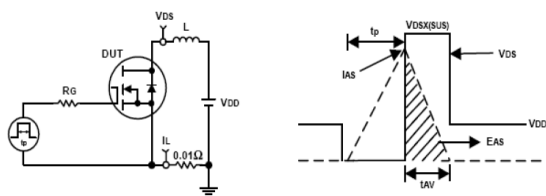


Fig10. Unclamped Inductive Test Circuit and waveforms

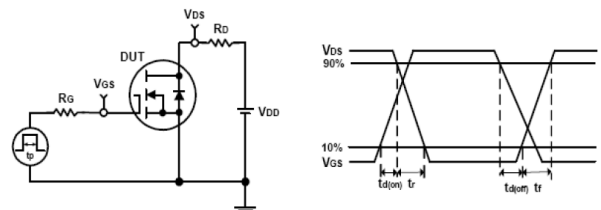
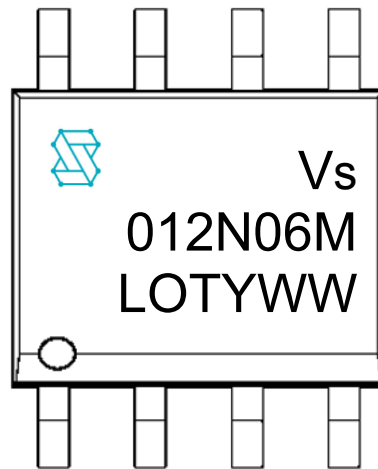


Fig11. Switching Time Test Circuit and waveforms

## Marking Information



1<sup>st</sup> line: Vanguard Code (Vs), Vanguard Logo

2<sup>nd</sup> line: Part Number (012N06M)

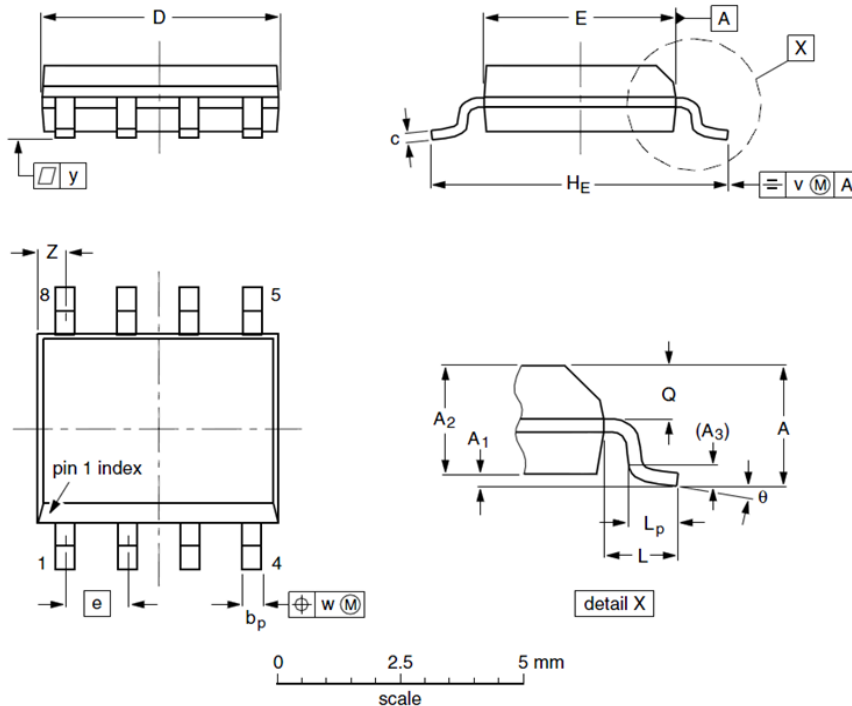
3<sup>rd</sup> line: Date code (LOTYWW)

LOT: Wafer Lot Number

Y: Year Code, e.g. E means 2017

WW: Week Code

### SOP8 Package Outline Data



Label	Dimensions (unit: mm)		
	Min	Typ	Max
A	--	--	1.75
A <sub>1</sub>	0.10	0.18	0.25
A <sub>2</sub>	1.25	1.35	1.50
A <sub>3</sub>	--	0.25	--
b <sub>p</sub>	0.36	0.42	0.51
c	0.19	0.22	0.25
D	4.80	4.92	5.00
E	3.80	3.90	4.00
e	--	1.27	--
H <sub>E</sub>	5.80	6.00	6.20
L	--	1.05	--
L <sub>p</sub>	0.40	0.68	1.00
Q	0.60	0.65	0.725
v	--	0.25	--
w	--	0.25	--
y	--	0.10	--
Z	0.30	0.50	0.70
θ	0°		8°

#### Notes:

1. Follow JEDEC MS-012.
2. Dimension "D" does NOT include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15mm per side.
3. Dimension "E" does NOT include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.25mm per side.
4. Dimension "b<sub>p</sub>" does NOT include dambar protrusion. Allowable dambar protrusion shall be 0.1mm total in excess of "b<sub>p</sub>" dimension at maximum material condition. The dambar cannot be located on the lower radius of the foot.

### Customer Service

#### Sales and Service:

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