

## N-Channel Power MOSFET

600V, 3A, 1.4Ω

### FEATURES

- Super-Junction technology
- High performance due to small figure-of-merit
- High ruggedness performance
- High commutation performance
- 100% UIL tested
- Pb-free plating
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

### KEY PERFORMANCE PARAMETERS

PARAMETER	VALUE	UNIT
V <sub>DS</sub>	600	V
R <sub>DS(on)</sub> (max)	1.4	Ω
Q <sub>g</sub>	7.12	nC



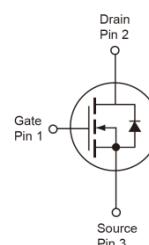
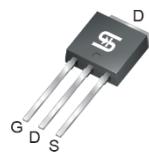
✓  
RoHS  
COMPLIANT

HALOGEN  
FREE

### APPLICATIONS

- Power Supply
- Lighting

TO-251 (IPAK)



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V <sub>DS</sub>	600	V
Gate-Source Voltage	V <sub>GS</sub>	±30	V
Continuous Drain Current <sup>(Note 1)</sup>	I <sub>D</sub>	3	A
		1.8	A
Pulsed Drain Current <sup>(Note 2)</sup>	I <sub>DM</sub>	9	A
Total Power Dissipation @ T <sub>C</sub> = 25°C	P <sub>DTOT</sub>	28.4	W
Single Pulsed Avalanche Energy <sup>(Note 3)</sup>	E <sub>AS</sub>	25	mJ
Single Pulsed Avalanche Current <sup>(Note 3)</sup>	I <sub>AS</sub>	1.0	A
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	- 55 to +150	°C

### THERMAL PERFORMANCE

PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Case Thermal Resistance	R <sub>θJC</sub>	4.4	°C/W
Junction to Ambient Thermal Resistance	R <sub>θJA</sub>	62	°C/W

**Thermal Performance Note:** R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins. R<sub>θJA</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design. R<sub>θJA</sub> shown below for single device operation on FR-4 PCB in still air.

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
<b>PARAMETER</b>	<b>CONDITIONS</b>	<b>SYMBOL</b>	<b>MIN</b>	<b>TYP</b>	<b>MAX</b>	<b>UNIT</b>
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}$ , $I_D = 250\mu\text{A}$	$BV_{DSS}$	600	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	$V_{GS(\text{TH})}$	2	3.3	4	V
Gate Body Leakage	$V_{GS} = \pm 30\text{V}$ , $V_{DS} = 0\text{V}$	$I_{GSS}$	--	--	$\pm 100$	nA
Zero Gate Voltage Drain Current	$V_{DS} = 600\text{V}$ , $V_{GS} = 0\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
Drain-Source On-State Resistance (Note 4)	$V_{GS} = 10\text{V}$ , $I_D = 0.9\text{A}$	$R_{DS(\text{on})}$	--	1	1.4	$\Omega$
<b>Dynamic</b> <sup>(Note 5)</sup>						
Total Gate Charge	$V_{DS} = 380\text{V}$ , $I_D = 3\text{A}$ , $V_{GS} = 10\text{V}$	$Q_g$	--	7.12	--	nC
Gate-Source Charge		$Q_{gs}$	--	3.52	--	
Gate-Drain Charge		$Q_{gd}$	--	1.62	--	
Input Capacitance	$V_{DS} = 100\text{V}$ , $V_{GS} = 0\text{V}$ , $f = 1.0\text{MHz}$	$C_{iss}$	--	257.3	--	pF
Output Capacitance		$C_{oss}$	--	41.5	--	
Gate Resistance	$F = 1\text{MHz}$ , open drain	$R_g$	--	4.1	--	$\Omega$
<b>Switching</b> <sup>(Note 6)</sup>						
Turn-On Delay Time	$V_{DD} = 380\text{V}$ , $R_{GEN} = 25\Omega$ , $I_D = 3\text{A}$ , $V_{GS} = 10\text{V}$ ,	$t_{d(on)}$	--	13.8	--	ns
Turn-On Rise Time		$t_r$	--	11.4	--	
Turn-Off Delay Time		$t_{d(off)}$	--	28	--	
Turn-Off Fall Time		$t_f$	--	8.4	--	
<b>Source-Drain Diode</b>						
Forward Voltage <sup>(Note 4)</sup>	$I_S = 3\text{A}$ , $V_{GS} = 0\text{V}$	$V_{SD}$	--	--	1.4	V
Reverse Recovery Time	$V_R = 200\text{V}$ , $I_S = 1.5\text{A}$ $dI_F/dt = 100\text{A}/\mu\text{s}$	$t_{rr}$	--	126	--	ns
Reverse Recovery Charge		$Q_{rr}$	--	0.637	--	$\mu\text{C}$

**Notes:**

1. Current limited by package.
2. Pulse width limited by the maximum junction temperature.
3.  $L = 50\text{mH}$ ,  $I_{AS} = 1.0\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse test:  $PW \leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

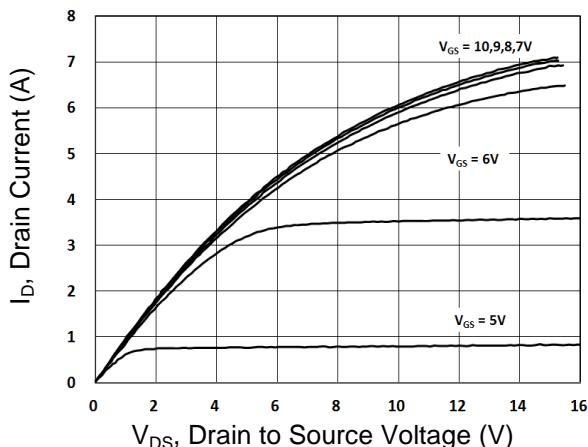
**ORDERING INFORMATION**

<b>PART NO.</b>	<b>PACKAGE</b>	<b>PACKING</b>
TSM60NB1R4CH C5G	TO-251 (IPAK)	75pcs / Tube

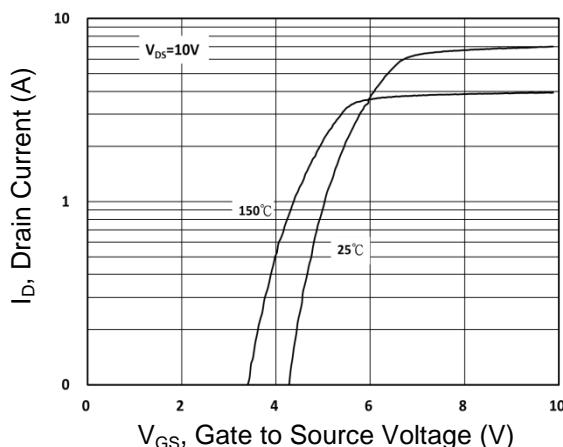
## CHARACTERISTICS CURVES

( $T_c = 25^\circ\text{C}$  unless otherwise noted)

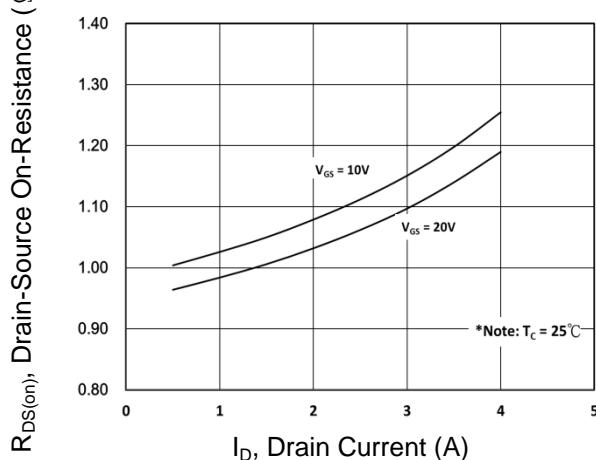
**Output Characteristics**



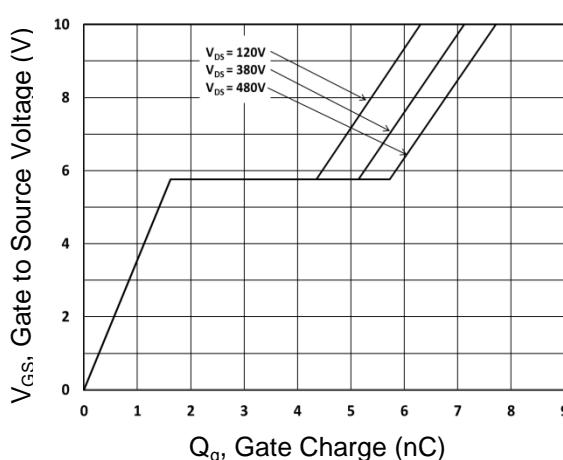
**Transfer Characteristics**



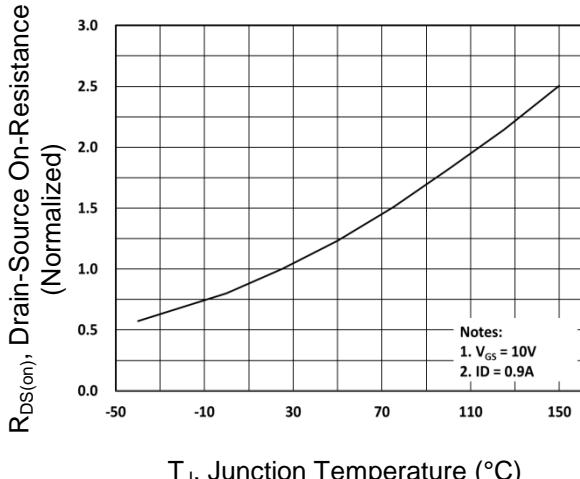
**On-Resistance vs. Drain Current**



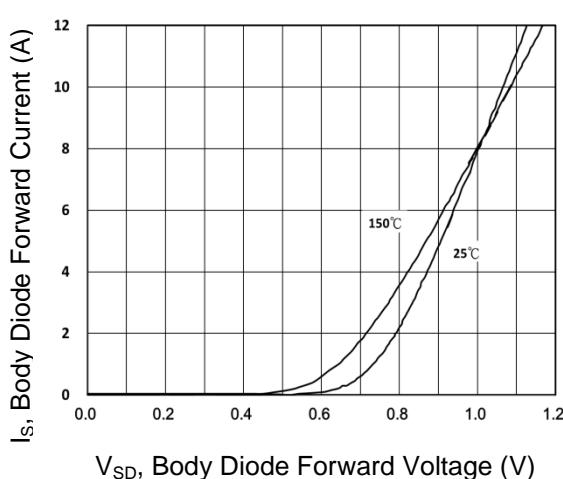
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



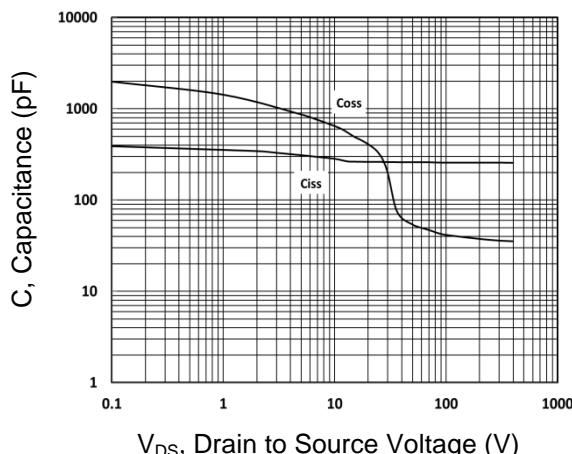
**Source-Drain Diode Forward Current vs. Voltage**



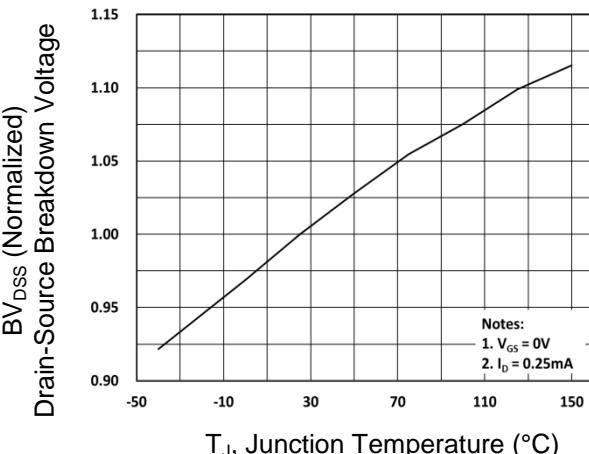
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( $T_C = 25^\circ\text{C}$  unless otherwise noted)

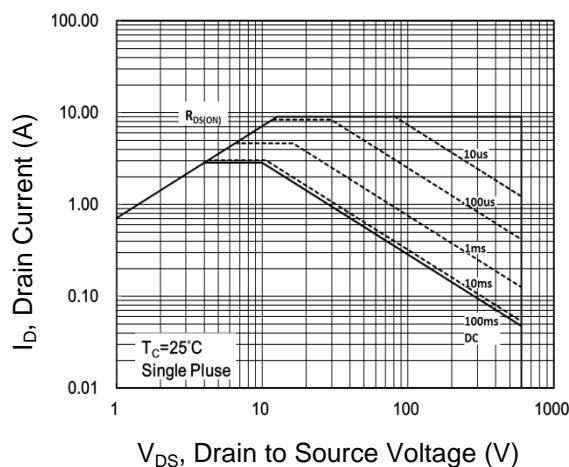
**Capacitance vs. Drain-Source Voltage**



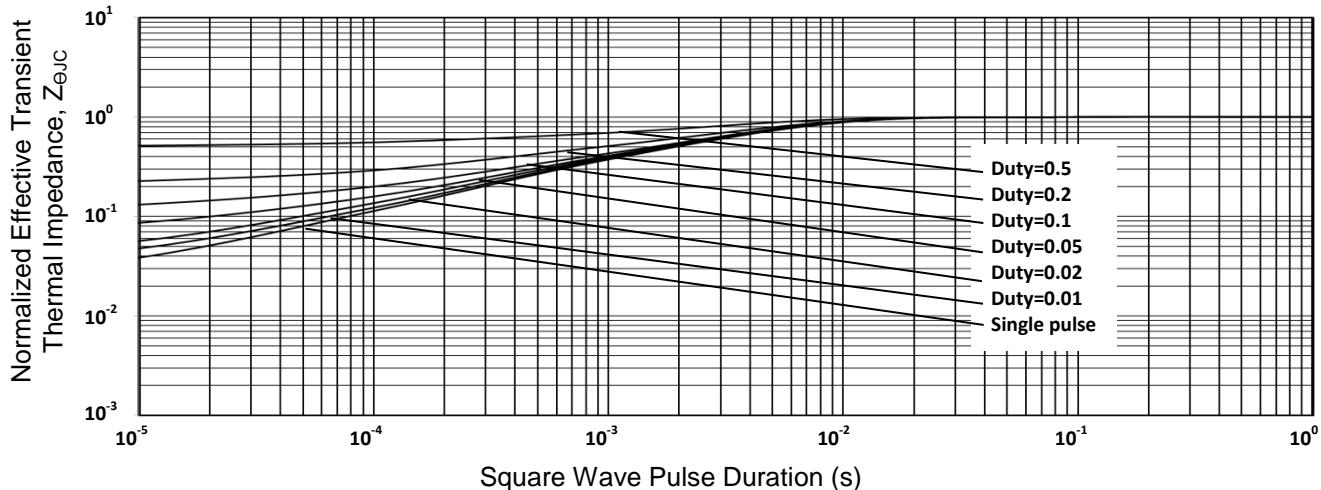
**BV<sub>DSS</sub> vs. Junction Temperature**



**Maximum Safe Operating Area**

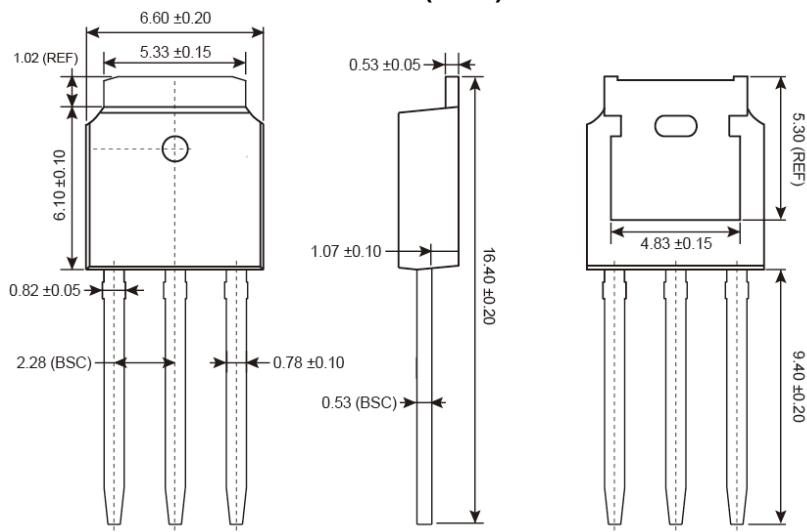


**Normalized Thermal Transient Impedance, Junction-to-Case**

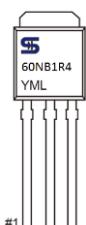


## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-251 (IPAK)



## MARKING DIAGRAM



**Y** = Year Code

**M** = Month Code for Halogen Free Product

**O** =Jan    **P** =Feb    **Q** =Mar    **R** =Apr

**S** =May    **T** =Jun    **U** =Jul    **V** =Aug

**W** =Sep    **X** =Oct    **Y** =Nov    **Z** =Dec

**L** = Lot Code (1~9, A~Z)

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
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