

N-Channel Power MOSFET

60V, 38A, 17mΩ

FEATURES

- 100% avalanche tested
- Suitable for 5V drive applications
- Pb-free plating
- RoHS compliant
- Halogen-free mold compound

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
V_{DS}	60	V
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	17
	$V_{GS} = 4.5V$	20
Q_g	15	nC

APPLICATION

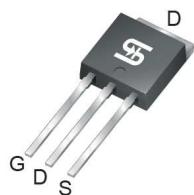
- SMPS Synchronous Rectification
- Networking DC-DC Power System



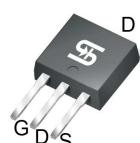
RoHS
COMPLIANT

**HALOGEN
FREE**

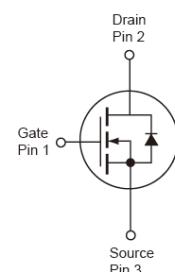
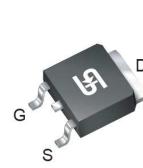
TO-251 (IPAK)



TO-251S (IPAK SL)



TO-252 (DPAK)



Notes: Moisture sensitivity level: level 3. Per J-STD-020

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ C$ unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ^(Note 1)	I_D	38	A
$T_C = 100^\circ C$		24	
Pulsed Drain Current ^(Note 2)	I_{DM}	152	A
Single Pulsed Avalanche Energy ^(Note 3)	E_{AS}	20	mJ
Single Pulsed Avalanche Current ^(Note 3)	I_{AS}	20	A
Total Power Dissipation @ $T_C = 25^\circ C$	P_{DTOT}	46	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	- 55 to +150	°C

THERMAL PERFORMANCE

PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Case Thermal Resistance	R_{eJC}	2.7	°C/W
Junction to Ambient Thermal Resistance	R_{eJA}	62	°C/W

Notes: R_{eJA} 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_{eJA} is guaranteed by design while R_{eCA} is determined by the user's board design. R_{eJA} shown below for single device operation on FR-4 PCB in still air

ELECTRICAL SPECIFICATIONS ($T_A = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static ^(Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}$, $I_D = 250\mu\text{A}$	BV_{DSS}	60	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$	$V_{GS(\text{TH})}$	1.2	1.7	2.5	V
Gate Body Leakage	$V_{GS} = \pm 20\text{V}$, $V_{DS} = 0\text{V}$	I_{GSS}	--	--	± 100	nA
Zero Gate Voltage Drain Current	$V_{DS} = 60\text{V}$, $V_{GS} = 0\text{V}$	I_{DSS}	--	--	1	μA
	$V_{DS} = 48\text{V}$, $V_{GS} = 0\text{V}$, $T_J = 125^\circ\text{C}$		--	--	10	
Drain-Source On-State Resistance	$V_{GS} = 10\text{V}$, $I_D = 20\text{A}$	$R_{DS(\text{ON})}$	--	15	17	$\text{m}\Omega$
	$V_{GS} = 4.5\text{V}$, $I_D = 10\text{A}$		--	17.5	20	
Dynamic ^(Note 5)						
Total Gate Charge	$V_{DS} = 30\text{V}$, $I_D = 10\text{A}$, $V_{GS} = 4.5\text{V}$	Q_g	--	15	--	nC
Gate-Source Charge		Q_{gs}	--	5.5	--	
Gate-Drain Charge		Q_{gd}	--	5	--	
Input Capacitance	$V_{DS} = 25\text{V}$, $V_{GS} = 0\text{V}$, $f = 1.0\text{MHz}$	C_{iss}	--	900	--	pF
Output Capacitance		C_{oss}	--	130	--	
Reverse Transfer Capacitance		C_{rss}	--	90	--	
Gate Resistance	$F = 1\text{MHz}$, open drain	R_g	--	2.2	--	Ω
Switching ^(Note 6)						
Turn-On Delay Time	$V_{GS} = 10\text{V}$, $V_{DS} = 15\text{V}$, $R_G = 6\Omega$, $I_D = 1\text{A}$	$t_{d(\text{on})}$	--	8.6	--	ns
Turn-On Rise Time		t_r	--	24.2	--	
Turn-Off Delay Time		$t_{d(\text{off})}$	--	32.3	--	
Turn-Off Fall Time		t_f	--	7.9	--	
Source-Drain Diode ^(Note 4)						
Diode Forward Voltage	$V_{GS} = 0\text{V}$, $I_S = 10\text{A}$	V_{SD}	--	--	1	V
Reverse Recovery Time	$V_{GS} = 0\text{V}$, $I_S = 10\text{A}$ $dI_F/dt = 100\text{A}/\mu\text{s}$	t_{rr}	--	18	--	ns
Reverse Recovery Charge		Q_{rr}	--	10	--	nC

Notes:

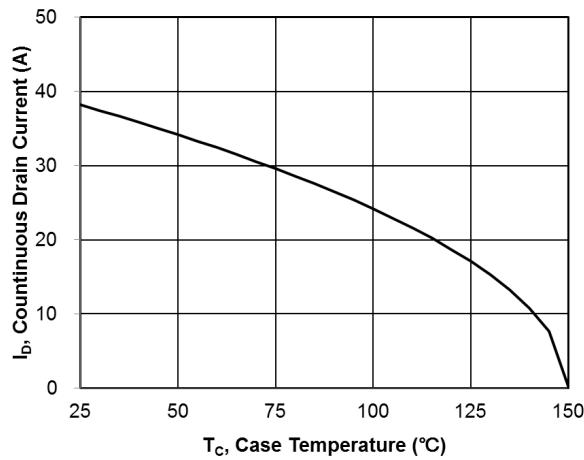
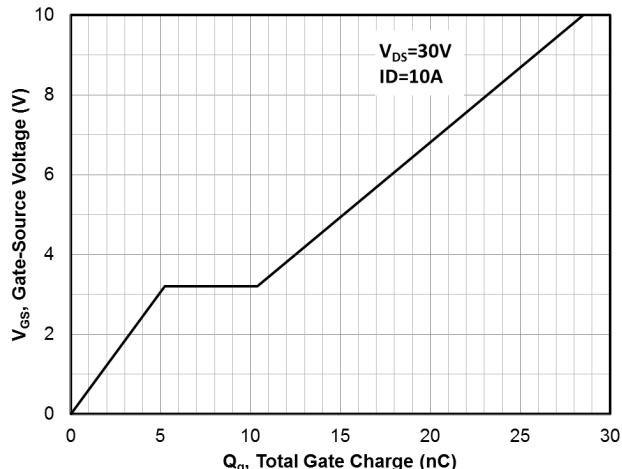
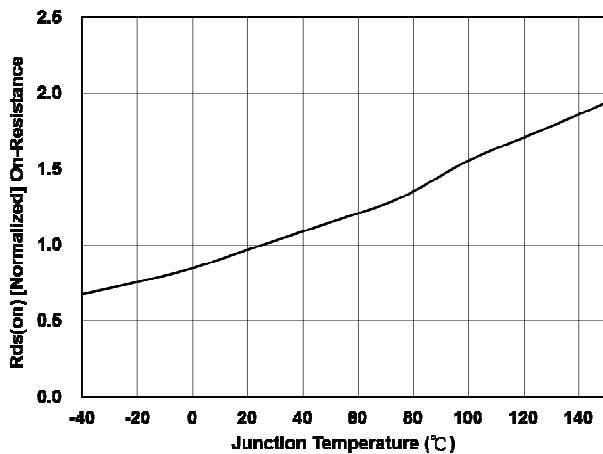
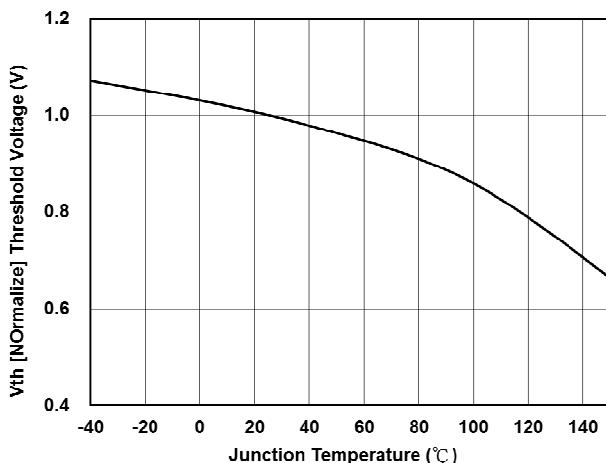
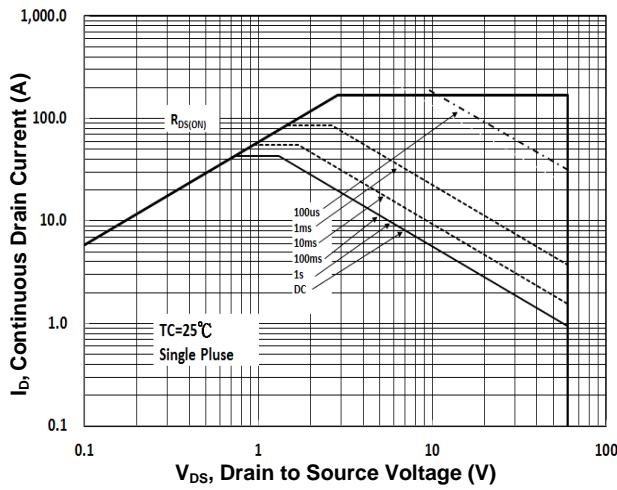
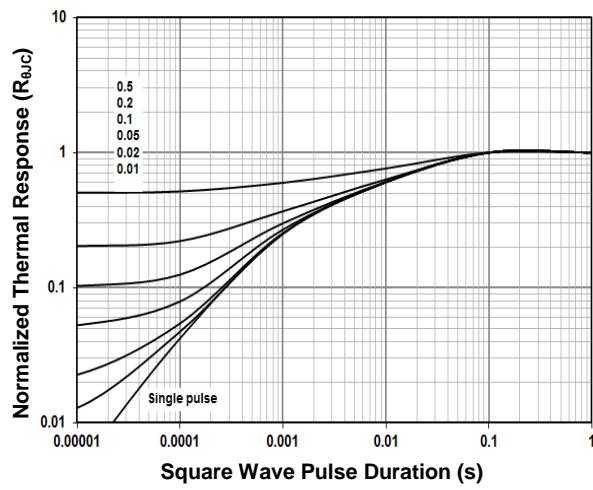
1. Current limited by package
2. Pulse width limited by the maximum junction temperature
3. $L = 0.1\text{mH}$, $I_{AS} = 20\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
4. Pulse test: $PW \leq 300\mu\text{s}$, duty cycle $\leq 2\%$
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

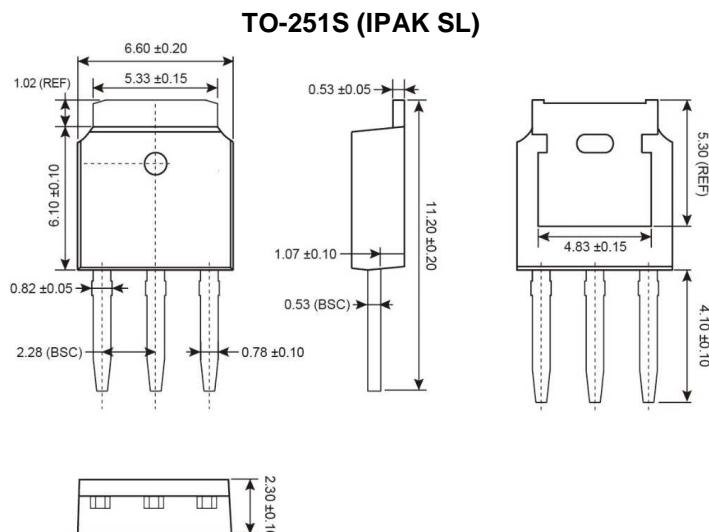
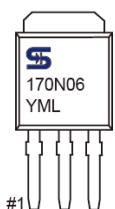
ORDERING INFORMATION

PART NO.	PACKAGE	PACKING
TSM170N06CP ROG	TO-252(DPAK)	2,500pcs / 13" Reel
TSM170N06CH C5G	TO-251(IPAK)	75pcs / Tube
TSM170N06CH X0G	TO-251S(IPAK SL)	75pcs / Tube

Note:

1. Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
2. Halogen-free according to IEC 61249-2-21 definition

CHARACTERISTICS CURVES
 $(T_C = 25^\circ\text{C} \text{ unless otherwise noted})$
Continuous Drain Current vs. T_C

Gate Charge

On-Resistance vs. Junction Temperature

Threshold Voltage vs. Junction Temperature

Maximum Safe Operating Area

Normalized Thermal Transient Impedance Curve


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

MARKING DIAGRAM

Y = Year Code

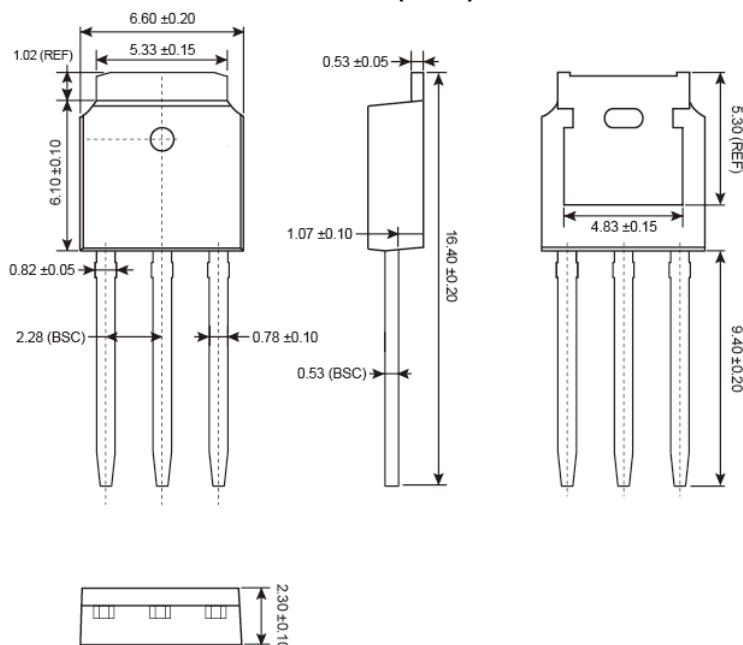
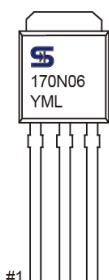
M = Month Code for Halogen Free Product

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)

PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)
TO-251 (IPAK)

MARKING DIAGRAM

Y = Year Code

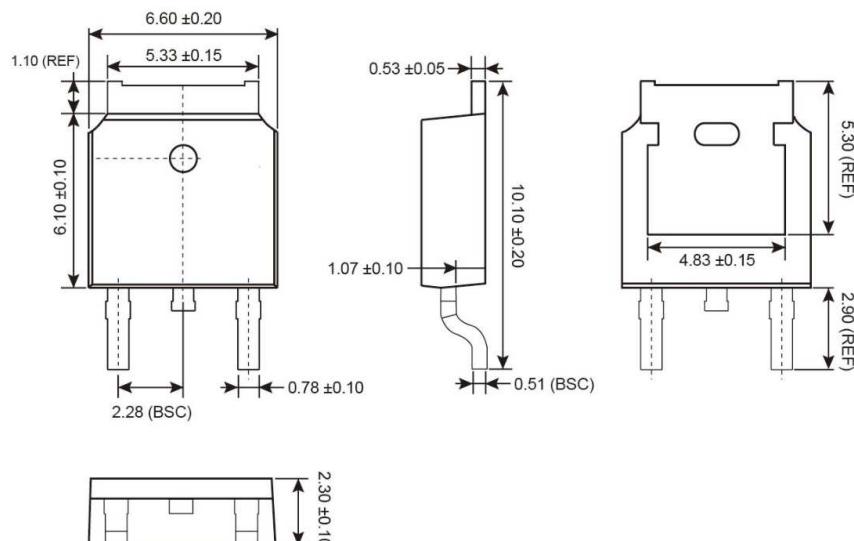
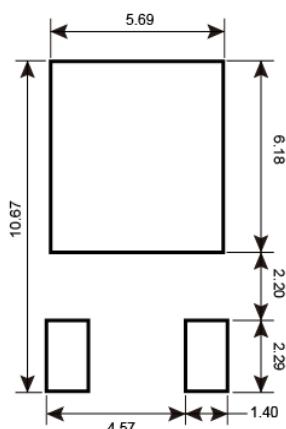
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PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)
TO-252 (DPAK)

SUGGESTED PAD LAYOUT (Unit: Millimeters)

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