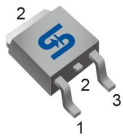


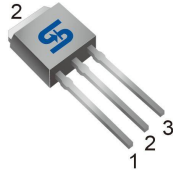
TSM60N1R4

600V, 3.3A, 1.4
N-Channel Power MOSFET

TO-252
(DPAK)



TO-251
(IPAK)



Pin Definition:

1. Gate
2. Drain
3. Source

Key Parameter Performance

Parameter	Value	Unit
V_{DS}	600	V
$R_{DS(on)}$ (max)	1.4	
Q_g	7.7	nC

Features

- Super-Junction technology
- High performance due to small figure-of-merit
- High ruggedness performance
- High commutation performance

Application

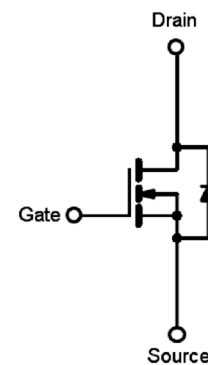
- Power Supply
- Lighting

Ordering Information

Part No.	Package	Packing
TSM60N1R4CH C5G	TO-251	75pcs / Tube
TSM60N1R4CP ROG	TO-252	2.5kpcs / 13+Reel

Note: %G+denotes for Halogen- and Antimony-free as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds

Block Diagram



N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current ^(Note 1)	I_D	3.3	A
Pulsed Drain Current ^(Note 2)			
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	P_{DTOT}	38	W
Single Pulsed Avalanche Energy ^(Note 3)	E_{AS}	64	mJ
Single Pulsed Avalanche Current ^(Note 3)	I_{AS}	1.6	A
Operating Junction and Storage Temperature Range	T_J, T_{STG}	- 55 to +150	$^\circ\text{C}$

Thermal Performance

Parameter	Symbol	Limit	Unit
Junction to Case Thermal Resistance	R_{JC}	3.3	$^\circ\text{C/W}$
Junction to Ambient Thermal Resistance	R_{JA}	62	$^\circ\text{C/W}$

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

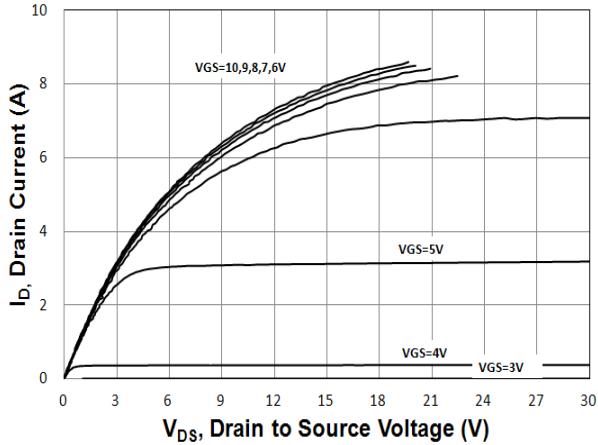
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	BV_{DSS}	600	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	$V_{GS(TH)}$	2	3	4	V
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	I_{GSS}	--	--	± 100	nA
Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	I_{DSS}	--	--	1	μA
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 2A$	$R_{DS(ON)}$	--	0.88	1.4	
Dynamic (Note 5)						
Total Gate Charge	$V_{DS} = 380V, I_D = 3.3A,$ $V_{GS} = 10V$	Q_g	--	7.7	--	nC
Gate-Source Charge		Q_{gs}	--	1.9	--	
Gate-Drain Charge		Q_{gd}	--	2.8	--	
Input Capacitance	$V_{DS} = 100V, V_{GS} = 0V,$ $f = 1.0MHz$	C_{iss}	--	370	--	pF
Output Capacitance		C_{oss}	--	34	--	
Gate Resistance	$f = 1MHz, \text{open drain}$	R_g	--	3.4	--	
Switching (Note 6)						
Turn-On Delay Time	$V_{DD} = 380V,$ $R_{GEN} = 25 \Omega,$ $I_D = 3.3A, V_{GS} = 10V,$	$t_{d(on)}$	--	14	--	ns
Turn-On Rise Time		t_r	--	22	--	
Turn-Off Delay Time		$t_{d(off)}$	--	24	--	
Turn-Off Fall Time		t_f	--	20	--	
Source-Drain Diode (Note 4)						
Forward On Voltage	$I_S = 3.3A, V_{GS} = 0V$	V_{SD}	--	--	1.4	V
Reverse Recovery Time	$V_R = 200V, I_S = 2A$ $di_f/dt = 100A/\mu s$	t_{rr}	--	163	--	ns
Reverse Recovery Charge		Q_{rr}	--	1	--	C

Notes:

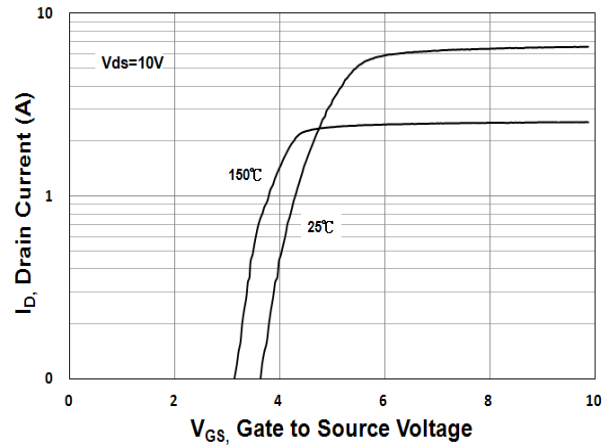
- Current limited by package
- Pulse width limited by the maximum junction temperature
- $L = 50mH, I_{AS} = 1.6A, V_{DD} = 50V, R_G = 25 \Omega$, Starting $T_J = 25^\circ\text{C}$
- Pulse test: PW $300\mu s$, duty cycle 2%
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

Electrical Characteristics Curves

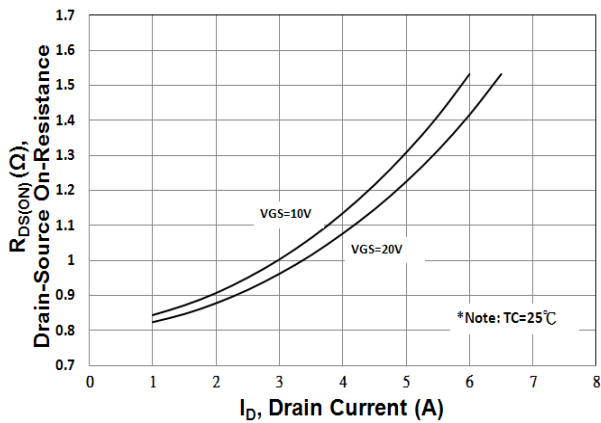
Output Characteristics



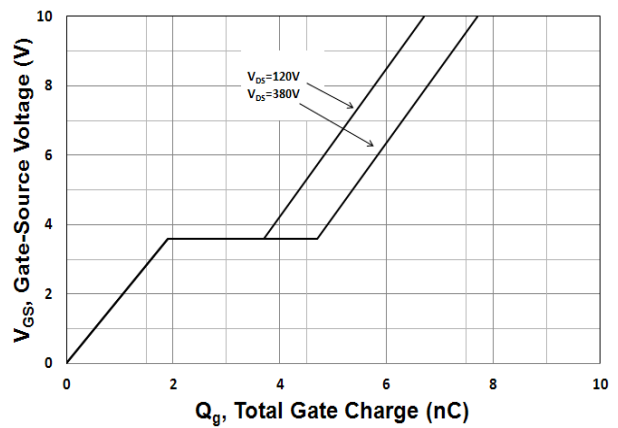
Transfer Characteristics



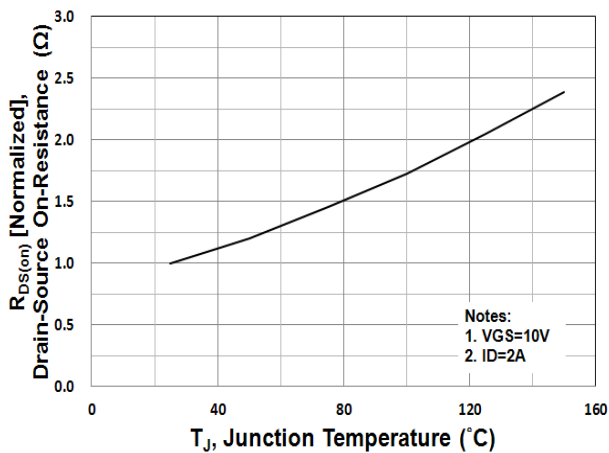
On-Resistance vs. Drain Current



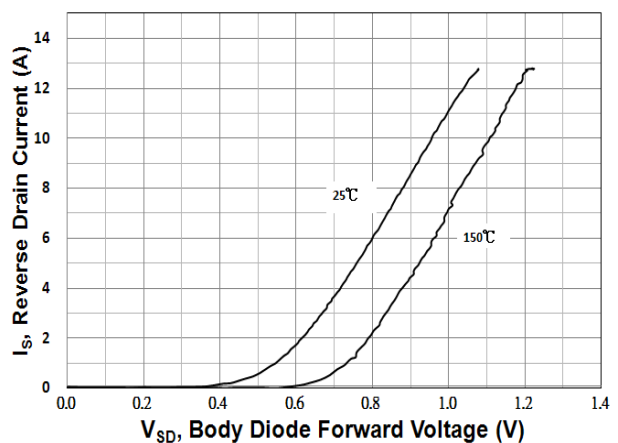
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature

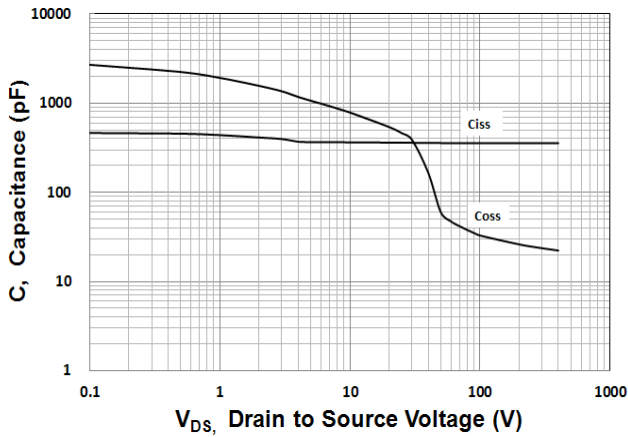


Source-Drain Diode Forward Current vs. Voltage

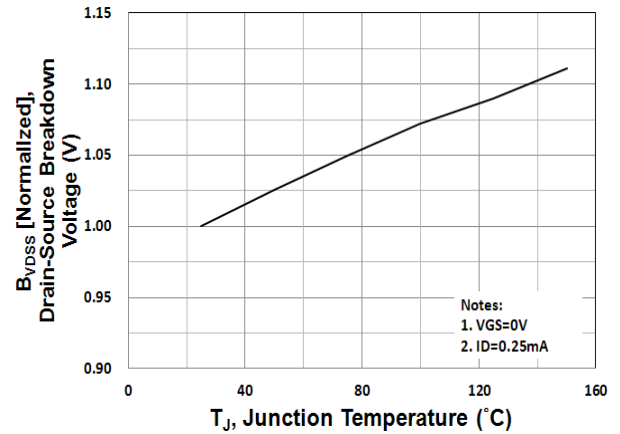


Electrical Characteristics Curves

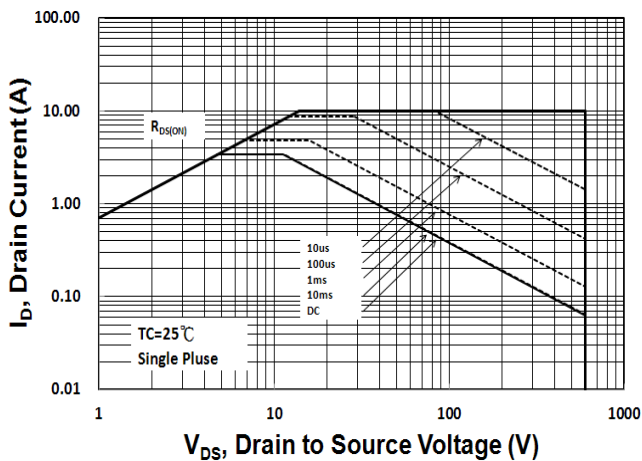
Capacitance vs. Drain-Source Voltage



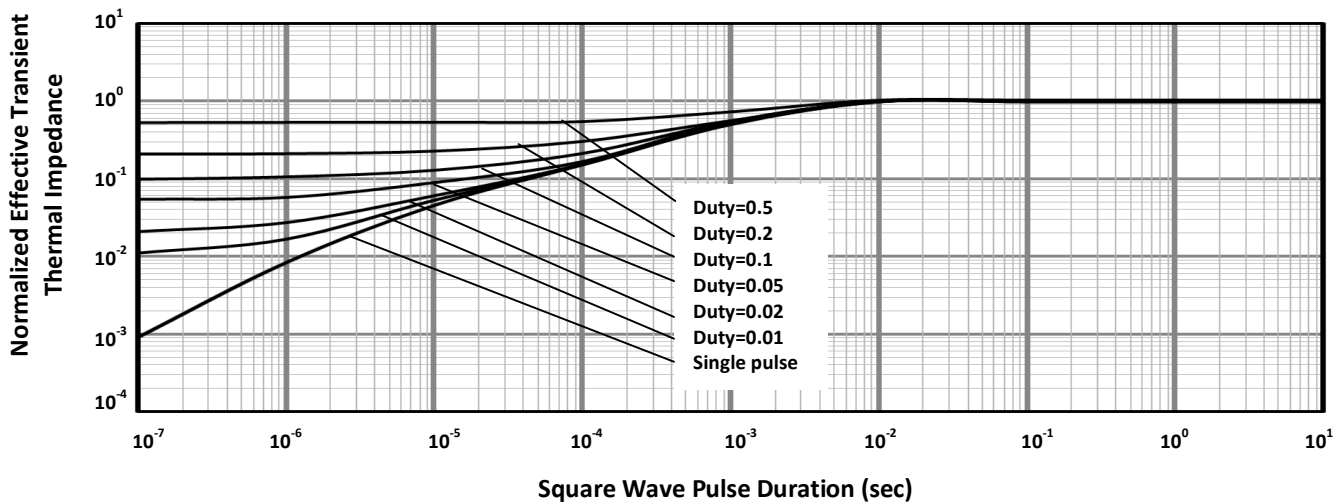
BV_{DSS} vs. Junction Temperature



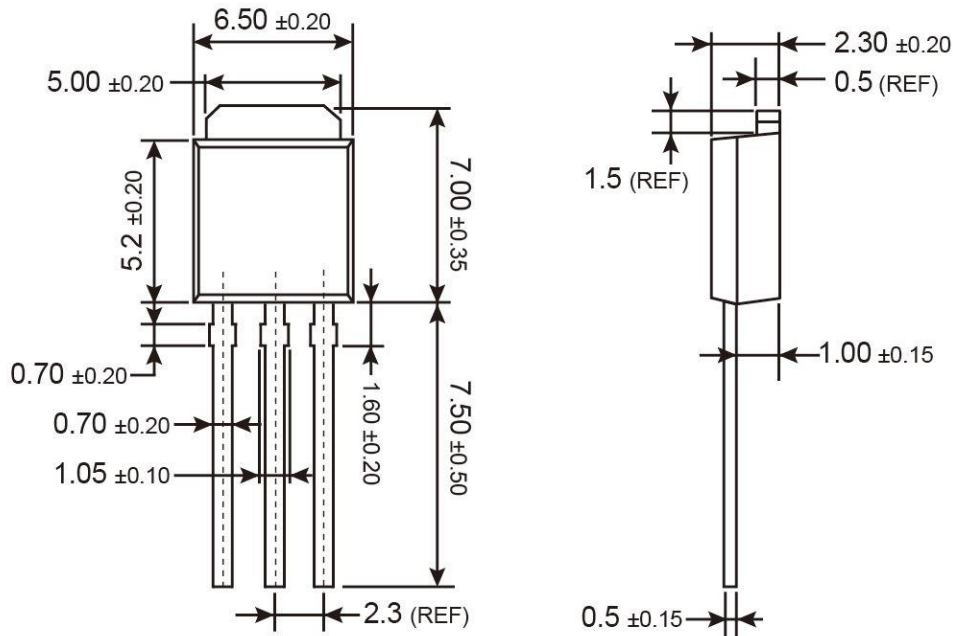
Maximum Safe Operating Area (DPAK/IPAK)



Normalized Thermal Transient Impedance, Junction-to-Case (DPAK/IPAK)

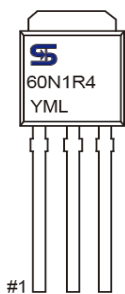


TO-251 (IPAK) Mechanical Drawing



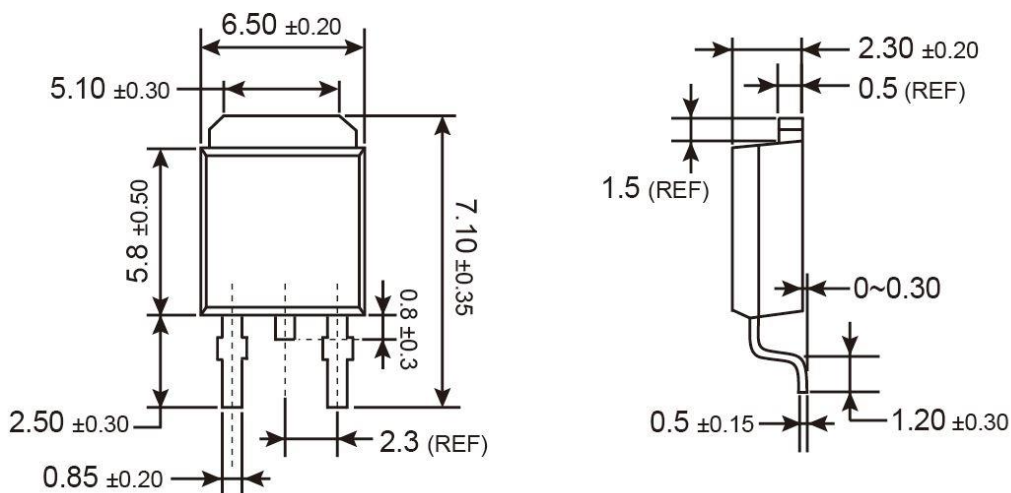
Unit: Millimeter

Marking Diagram



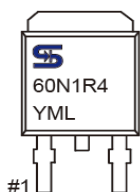
- Y** = Year Code
- M** = Month Code for Halogen Free Product
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apr, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct, **Y**=Nov, **Z**=Dec)
- L** = Lot Code

TO-252 (DPAK) Mechanical Drawing



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

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