

N-Channel Power MOSFET

FEATURES

- Super-Junction technology
- High performance good FOM
- High ruggedness performance
- 100% UIS & R_g tested
- High commutation performance
- ROHS Compliant
- Halogen-free

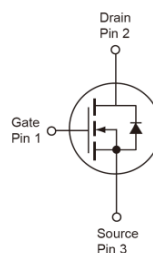
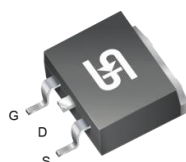
APPLICATIONS

- Power Supply
- AC/DC LED Lighting

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on)}$ (max)	196	m Ω
$Q_{g,typ}$	39	nC



TO-263-2L (D²PAK-2L)



Note: MSL 3 (Moisture Sensitivity Level) per J-STD-020

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current (Note 1)	$T_C = 25^\circ\text{C}$	I_D	28	A
	$T_C = 100^\circ\text{C}$		18	A
Pulsed Drain Current (Note 2)		I_{DM}	84	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$		P_D	152	W
Single Pulse Avalanche Energy (Note 3)		E_{AS}	440	mJ
Single Pulse Avalanche Current (Note 3)		I_{AS}	4.2	A
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

THERMAL PERFORMANCE			
PARAMETER	SYMBOL	MAXIMUM	UNIT
Junction to Case Thermal Resistance	$R_{\theta JC}$	0.82	$^\circ\text{C/W}$
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	40	$^\circ\text{C/W}$

Thermal Performance Note: $R_{\theta JA}$ 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. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

ELECTRICAL SPECIFICATIONS (T _A = 25°C unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static						
Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 1mA	BV _{DSS}	600	--	--	V
Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 1mA	V _{GS(TH)}	3	4.2	5	V
Gate Body Leakage	V _{GS} = ±20V, 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 (Note 4)	V _{GS} = 10V, I _D = 9.5A	R _{DS(on)}	--	182	196	mΩ
Dynamic (Note 5)						
Total Gate Charge	V _{DS} = 300V, I _D = 20A, V _{GS} = 10V	Q _g	--	39	--	nC
Gate-Source Charge		Q _{gs}	--	12	--	
Gate-Drain Charge		Q _{gd}	--	17	--	
Input Capacitance	V _{DS} = 300V, V _{GS} = 0V, f = 1.0MHz	C _{iss}	--	1566	--	pF
Output Capacitance		C _{oss}	--	46	--	
Reverse Transfer Capacitance		C _{rss}	--	11	--	
Gate Resistance	f = 1.0MHz	R _g	--	2.3	4.6	Ω
Switching (Note 6)						
Turn-On Delay Time	V _{DD} = 300V, R _G = 10Ω, I _D = 10A, V _{GS} = 10V,	t _{d(on)}	--	32	--	ns
Turn-On Rise Time		t _r	--	31	--	
Turn-Off Delay Time		t _{d(off)}	--	55	--	
Turn-Off Fall Time		t _f	--	11	--	
Source-Drain Diode						
Body-Diode Continuous Forward Current		I _S	--	--	20	A
Body-Diode Pulsed Current		I _{SM}	--	--	60	A
Forward Voltage (Note 4)	I _S = 20A, V _{GS} = 0V	V _{SD}	--	--	1.5	V
Reverse Recovery Time	I _S = 20A	t _{rr}	--	420	--	ns
Reverse Recovery Charge	dl _F /dt = 100A/μs	Q _{rr}	--	8.4	--	μC

Notes:

- Current limited by package.
- Pulse width limited by the maximum junction temperature.
- $L = 50mH, I_{AS} = 4.2A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
- Pulse test: $PW \leq 300\mu s$, duty cycle $\leq 2\%$.
- For DESIGN AID ONLY, not subject to production testing.
- Switching time is essentially independent of operating temperature.

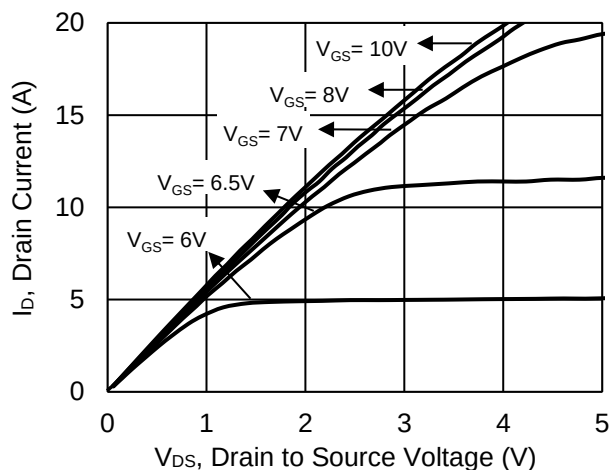
ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSM60NC196CM2 RNG	TO-263-2L (D ² PAK-2L)	800pcs / 13" Reel

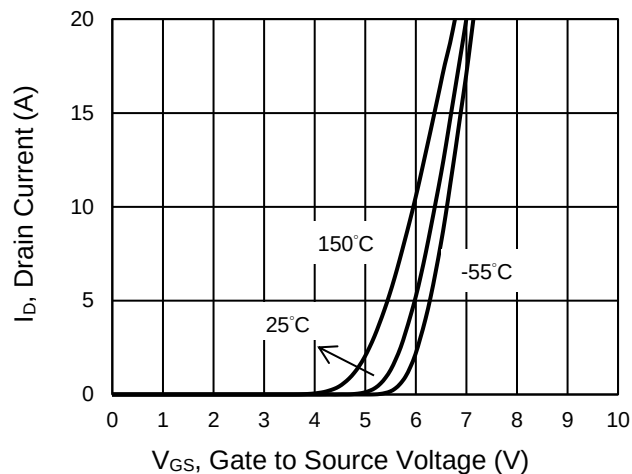
CHARACTERISTICS CURVES

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

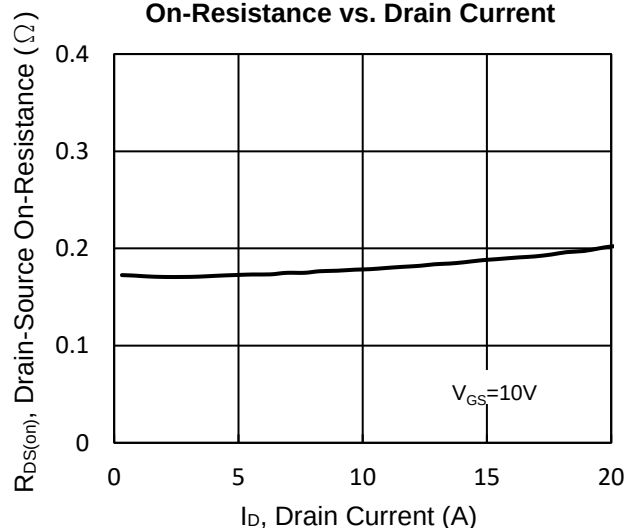
Output Characteristics



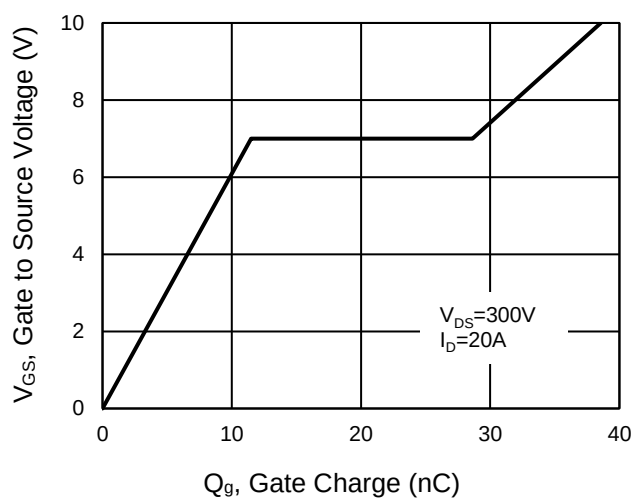
Transfer Characteristics



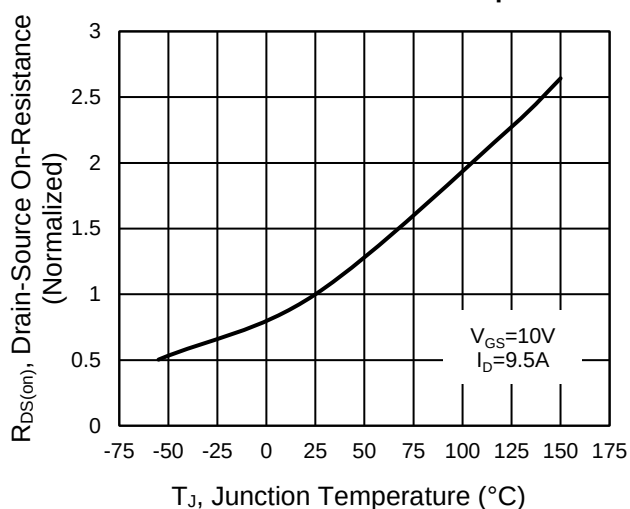
On-Resistance vs. Drain Current



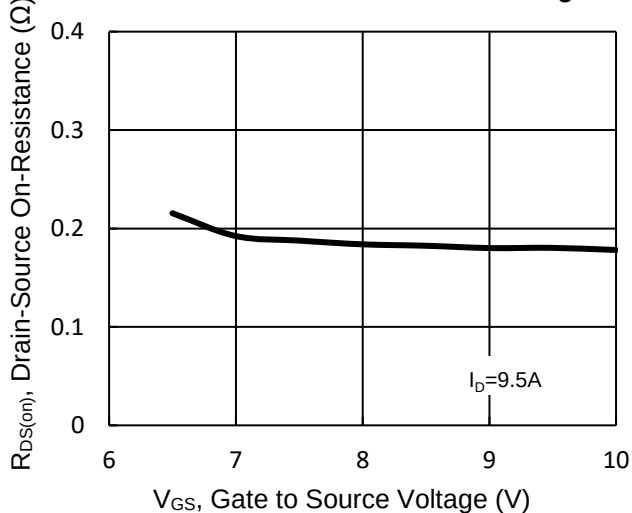
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



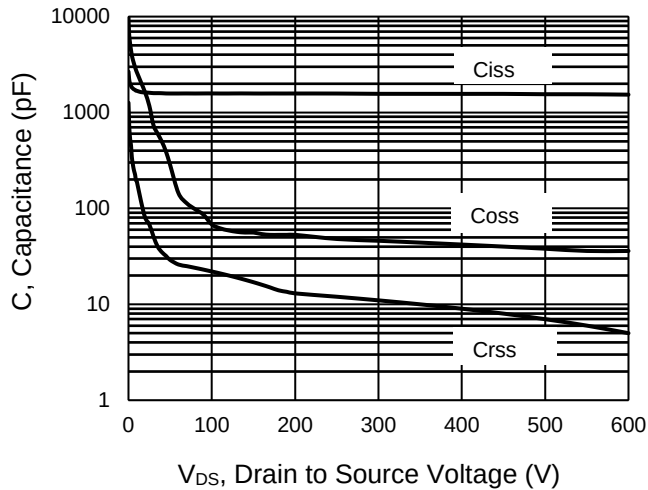
On-Resistance vs. Gate-Source Voltage



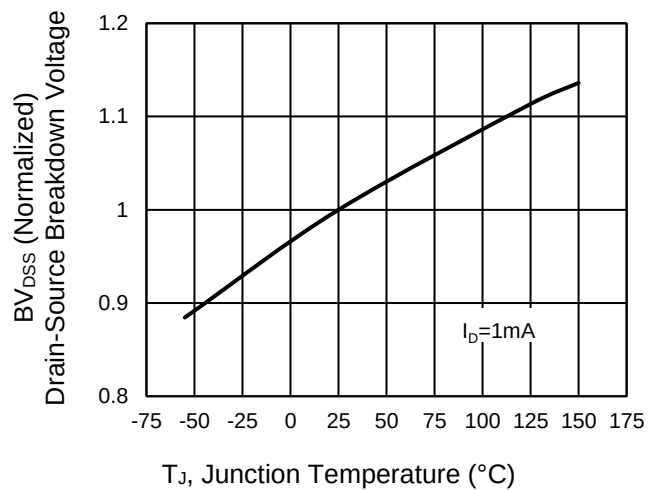
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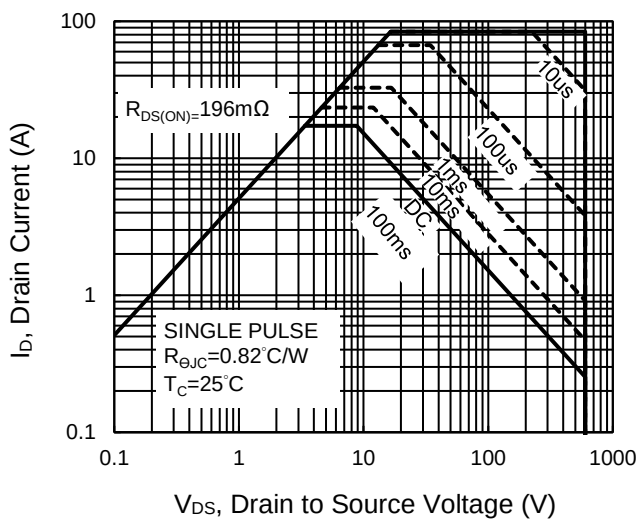
Capacitance vs. Drain-Source Voltage



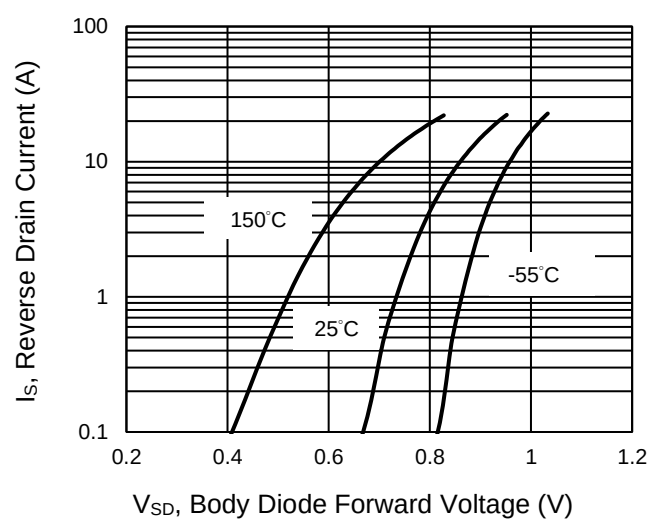
BV_{DSS} vs. Junction Temperature



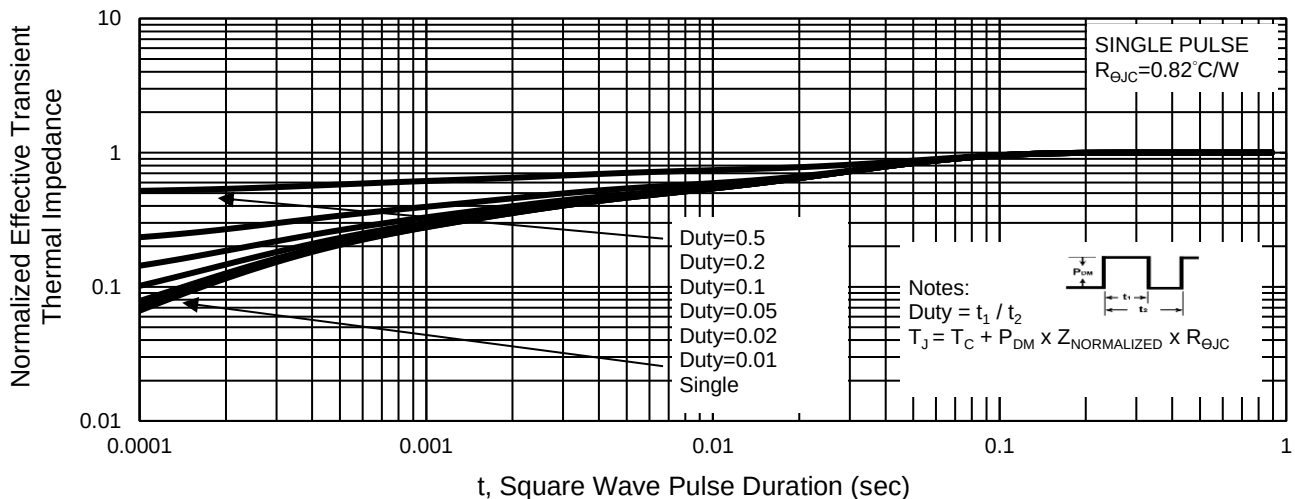
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage

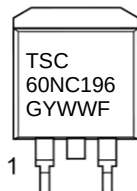
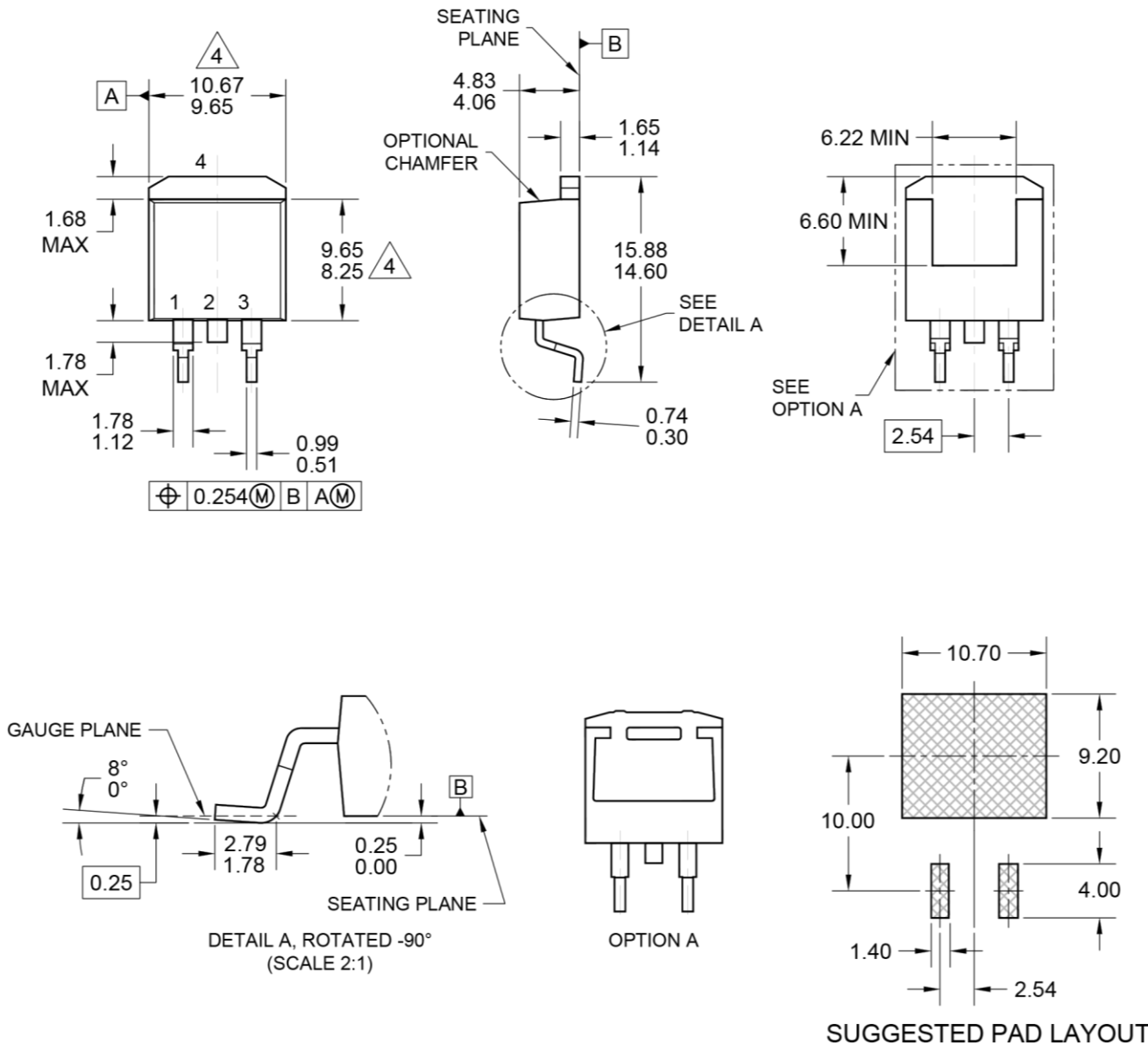


Normalized Thermal Transient Impedance, Junction-to-Case



PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-263



MARKING DIAGRAM

60NC196 = Device marking
G = Halogen Free
Y = Year Code)
WW = Week Code (01~52)
F = Factory Code

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. THE PACKAGE OUTLINE REFERENCE: JEDEC TO-263, VARIATION AB, ISSUE F.

4 MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.

5. DWG NO REF: HQ2SD07-TO263AB-008 REV A.

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