
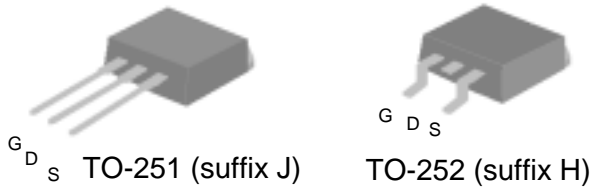


# N-channel Enhancement-mode Power MOSFET

## PRODUCT SUMMARY

$BV_{DSS}$	30V
$R_{DS(ON)}$	12m $\Omega$
$I_D$	45A

 **Pb-free; RoHS-compliant TO-251 (IPAK) and TO-252 (DPAK)**



## DESCRIPTION

The SSM60T03 achieves fast switching performance with low gate charge without a complex drive circuit. It is suitable for low voltage applications such as DC/DC converters and general load-switching circuits.

The SSM60T03GH is in a TO-252 package, which is widely used for commercial and industrial surface-mount applications.

The through-hole version, the SSM60T03GJ in TO-251, is available for vertical mounting, where a small footprint is required on the board, and/or an external heatsink is to be attached.

These devices are manufactured with an advanced process, providing improved on-resistance and switching performance. The devices have a maximum junction temperature rating of 175°C for improved thermal margin and reliability.

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Units
$V_{DS}$	Drain-source voltage	30	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Continuous drain current, $T_C = 25^\circ\text{C}$	45	A
	$T_C = 100^\circ\text{C}$	32	A
$I_{DM}$	Pulsed drain current <sup>1</sup>	120	A
$P_D$	Total power dissipation, $T_C = 25^\circ\text{C}$	44	W
	Linear derating factor	0.352	W/ $^\circ\text{C}$
$E_{AS}$	Single pulse avalanche energy <sup>3</sup>	29	mJ
$T_{STG}$	Storage temperature range	-55 to 175	$^\circ\text{C}$
$T_J$	Operating junction temperature range	-55 to 175	$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Maximum thermal resistance, junction-case	3.4	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Maximum thermal resistance, junction-ambient	110	$^\circ\text{C}/\text{W}$

### Notes:

- Pulse width must be limited to avoid exceeding the safe operating area.
- Pulse width <300us, duty cycle <2%.
- $V_{DD}=25\text{V}$ ,  $L=100\mu\text{H}$ ,  $R_G=25\Omega$ ,  $I_{AS}=24\text{A}$ .

**ELECTRICAL CHARACTERISTICS** (at  $T_j = 25^\circ\text{C}$ , unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{DSS}$	Drain-source breakdown voltage	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
$\Delta BV_{DSS}/\Delta T_j$	Breakdown voltage temperature coefficient	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$	-	0.026	-	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static drain-source on-resistance	$V_{GS}=10V, I_D=20A$	-	-	12	$\text{m}\Omega$
		$V_{GS}=4.5V, I_D=15A$	-	-	25	$\text{m}\Omega$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	-	3	V
$g_{fs}$	Forward transconductance	$V_{DS}=10V, I_D=10A$	-	25	-	S
$I_{DSS}$	Drain-source leakage current	$V_{DS}=30V, V_{GS}=0V$	-	-	1	$\mu A$
		$V_{DS}=24V, V_{GS}=0V, T_j=175^\circ\text{C}$	-	-	250	$\mu A$
$I_{GSS}$	Gate-source leakage current	$V_{GS} = \pm 20V$	-	-	$\pm 100$	nA
$Q_g$	Total gate charge <sup>2</sup>	$I_D=20A$	-	11.6	-	nC
$Q_{gs}$	Gate-source charge	$V_{DS}=20V$	-	3.9	-	nC
$Q_{gd}$	Gate-drain ("Miller") charge	$V_{GS}=4.5V$	-	7	-	nC
$t_{d(on)}$	Turn-on delay time <sup>2</sup>	$V_{DS}=15V$	-	8.8	-	ns
$t_r$	Rise time	$I_D=20A$	-	57.5	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G=3.3\Omega, V_{GS}=10V$	-	18.5	-	ns
$t_f$	Fall time	$R_D=0.75\Omega$	-	6.4	-	ns
$C_{iss}$	Input capacitance	$V_{GS}=0V$	-	1135	-	pF
$C_{oss}$	Output capacitance	$V_{DS}=25V$	-	200	-	pF
$C_{riss}$	Reverse transfer capacitance	$f=1.0\text{MHz}$	-	135	-	pF

**Source-Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{SD}$	Forward voltage <sup>2</sup>	$I_S=45A, V_{GS}=0V$	-	-	1.3	V
$t_{rr}$	Reverse-recovery time <sup>2</sup>	$I_S=20A, V_{GS}=0V,$	-	23.3	-	ns
$Q_{rr}$	Reverse-recovery charge	$di/dt=100A/\mu s$	-	16	-	nC

**Notes:**

1. Pulse width must be limited to avoid exceeding the safe operating area.
2. Pulse width  $< 300\mu s$ , duty cycle  $< 2\%$ .
3.  $V_{DD}=25V$ ,  $L=100\mu H$ ,  $R_G=25\Omega$ ,  $I_{AS}=24A$ .

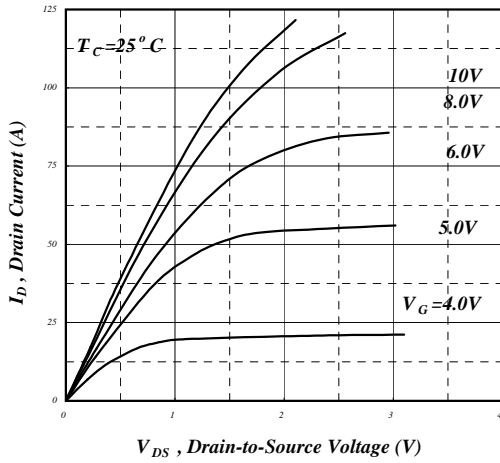


Fig 1. Typical Output Characteristics

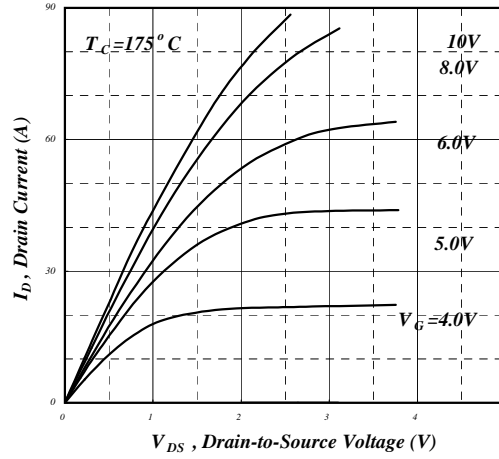


Fig 2. Typical Output Characteristics

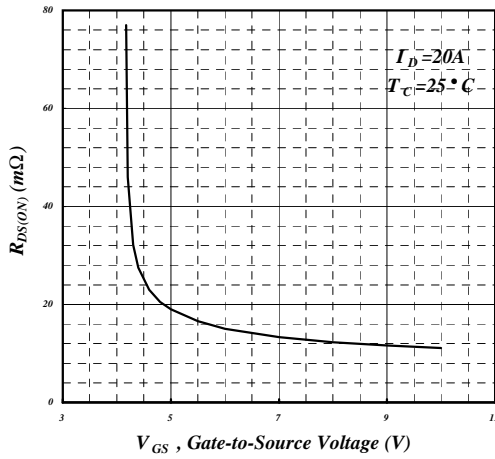


Fig 3. On-Resistance vs. Gate Voltage

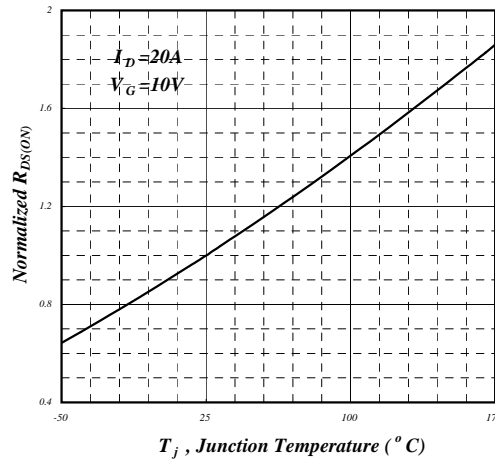


Fig 4. Normalized On-Resistance vs. Junction Temperature

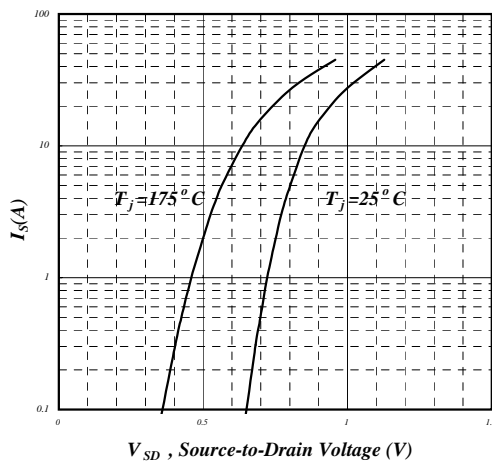


Fig 5. Forward Characteristic of Reverse Diode

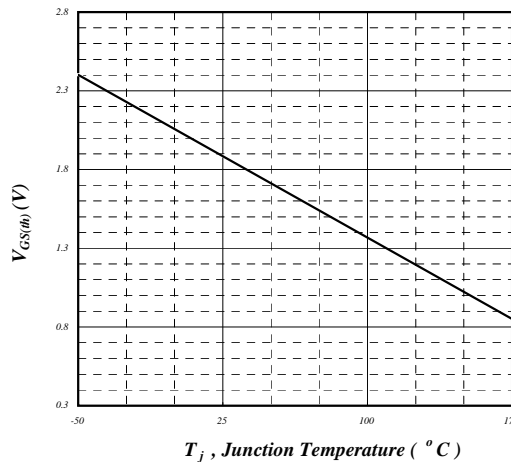


Fig 6. Gate Threshold Voltage vs. Junction Temperature

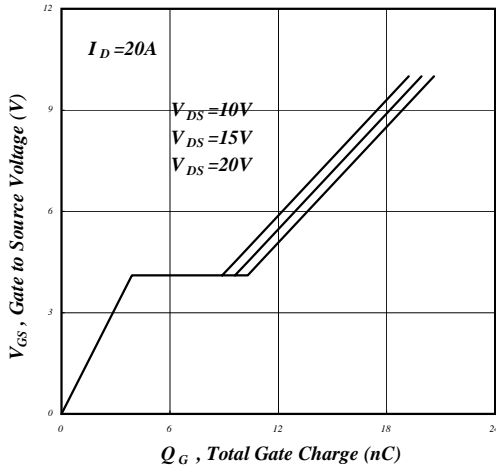


Fig 7. Gate Charge Characteristics

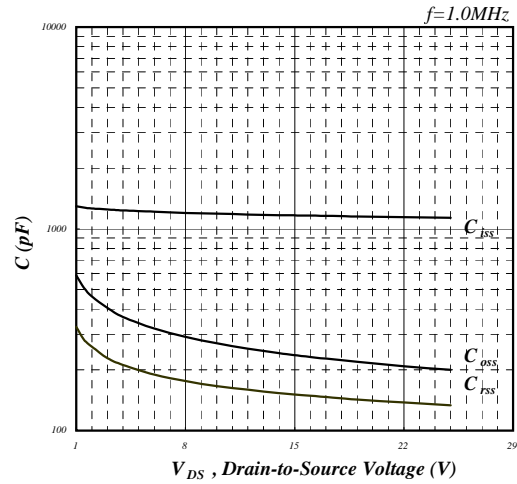


Fig 8. Typical Capacitance Characteristics

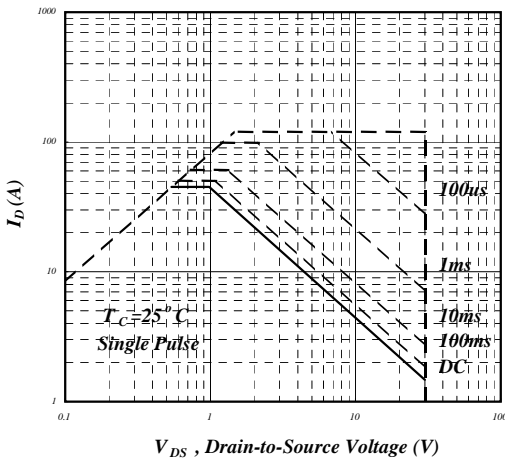


Fig 9. Maximum Safe Operating Area

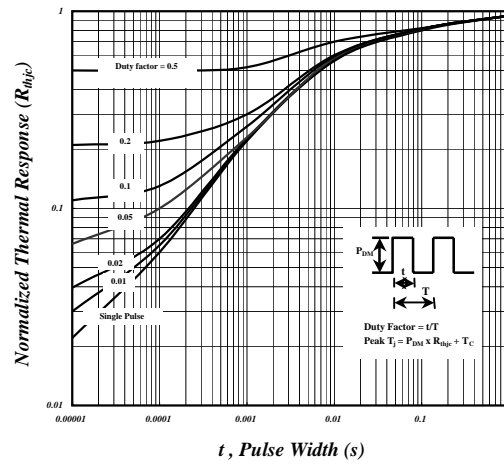


Fig 10. Effective Transient Thermal Impedance

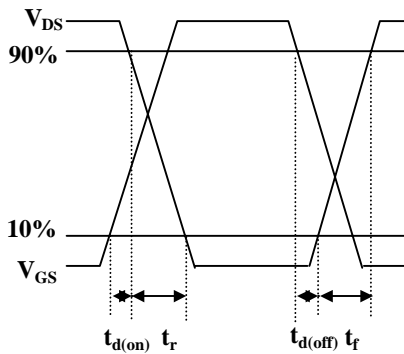


Fig 11. Switching Time Waveform

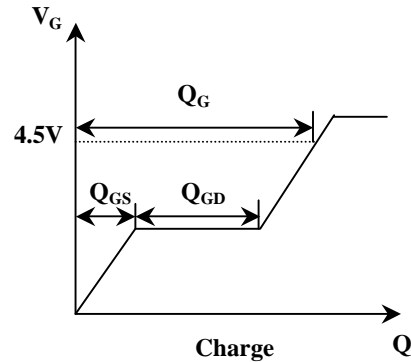
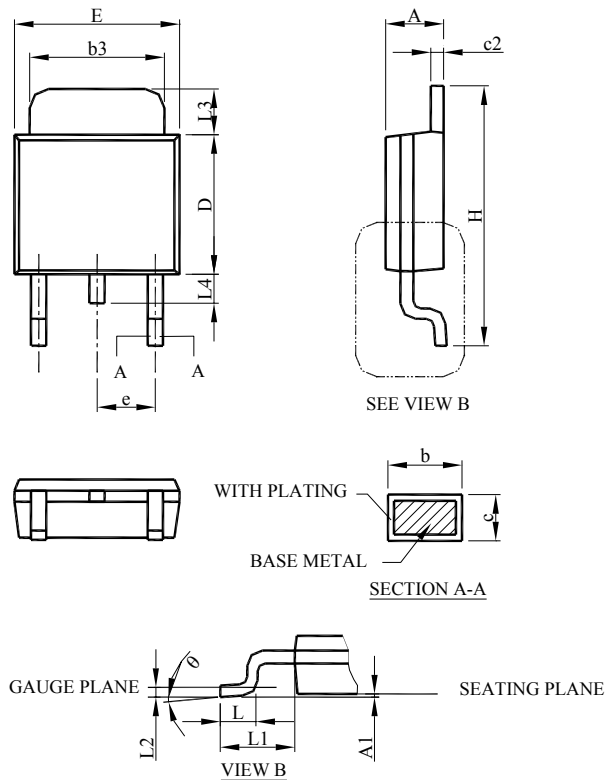


Fig 12. Gate Charge Waveform

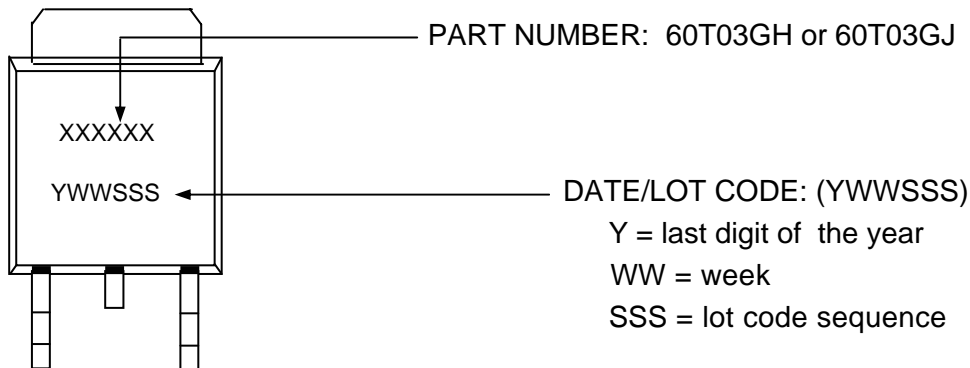
## PHYSICAL DIMENSIONS



SYMBOL	TO-252-3L	
	MILLIMETERS	
	MIN.	MAX.
A	1.80	2.80
A1	0.00	0.13
b	0.40	1.00
b3	4.80	5.90
c	0.35	0.65
c2	0.40	0.89
D	5.10	6.30
E	6.00	7.00
e	2.30 BSC	
H	7.80	11.05
L	1.00	2.55
L1	2.20	3.05
L2	0.35	0.65
L3	0.50	2.03
L4	0.50	1.20
$\theta$	0°	8°

\*Dimensions do not include mold protrusions.

## PART MARKING



## PACKING: Moisture sensitivity level MSL3

TO-252: 3000 pcs in antistatic tape on a reel packed inside a moisture barrier bag (MBB).

TO-251: 1000pcs in an antistatic bag packed inside a moisture barrier bag (MBB).

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