

## P-Ch 20V Fast Switching MOSFETs

### General Description

The MA2403C1 is the highest performance trench P-ch MOSFETs with extreme high cell density, which provide excellent R<sub>DS(on)</sub> and gate charge for most of the small power switching and load switch applications.

The MA2403C1 meet the RoHS and Green Product requirement, with full function reliability approved.

### Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- Green Device Available

### Product Summary

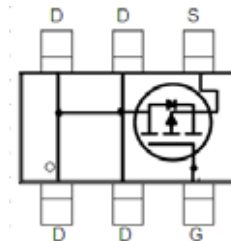
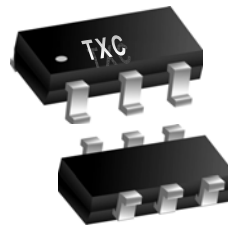


BVDSS	R <sub>DS(on)</sub>	I <sub>D</sub>
-20V	60mΩ	-2A

### Applications

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- Load Switch

### SOT363 (SC-70-6L) Pin Configuration



### Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V <sub>DS</sub>	Drain-Source Voltage	-20	V
V <sub>GS</sub>	Gate-Source Voltage	± 8	V
I <sub>D</sub> @T <sub>A</sub> =25	Continuous Drain Current, V <sub>GS</sub> @ -4.5V <sup>1</sup>	-2	A
I <sub>D</sub> @T <sub>A</sub> =70	Continuous Drain Current, V <sub>GS</sub> @ -4.5V <sup>1</sup>	-1.6	A
I <sub>DM</sub>	Pulsed Drain Current <sup>2</sup>	-8	A
P <sub>D</sub> @T <sub>A</sub> =25	Total Power Dissipation <sup>3</sup>	0.33	W
T <sub>STG</sub>	Storage Temperature Range	-55 to 150	
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150	

### Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJA</sub>	Thermal Resistance Junction-Ambient <sup>1</sup>	---	375	/W
R <sub>θJC</sub>	Thermal Resistance Junction-Case <sup>1</sup>	---	240	/W

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### Electrical Characteristics ( $T_J=25$ , unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-20	---	---	V
$BV_{DSS}/T_J$	$BV_{DSS}$ Temperature Coefficient	Reference to 25 , $I_D=-1mA$	---	-0.016	---	V/
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=-4.5V, I_D=-2A$	---	48	60	m $\Omega$
		$V_{GS}=-2.5V, I_D=-1A$	---	60	75	
		$V_{GS}=-1.8V, I_D=-0.5A$	---	75	94	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-0.3	-0.5	-1.0	V
$V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	3.97	---	mV/
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=-16V, V_{GS}=0V, T_J=25$	---	---	-1	$\mu A$
		$V_{DS}=-16V, V_{GS}=0V, T_J=55$	---	---	-5	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 8V, V_{DS}=0V$	---	---	$\pm 100$	nA
gfs	Forward Transconductance	$V_{DS}=-5V, I_D=-2A$	---	12.6	---	S
$Q_g$	Total Gate Charge (-4.5V)	$V_{DS}=-15V, V_{GS}=-4.5V, I_D=-2A$	---	11.8	16.5	nC
$Q_{gs}$	Gate-Source Charge		---	1.46	2.0	
$Q_{gd}$	Gate-Drain Charge		---	2.84	4.0	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-10V, V_{GS}=-4.5V, R_G=3.3\Omega, I_D=-2A$	---	4.2	8.4	ns
$T_r$	Rise Time		---	35.2	63	
$T_{d(off)}$	Turn-Off Delay Time		---	46.8	94	
$T_f$	Fall Time		---	26.4	52.8	
$C_{iss}$	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1MHz$	---	938	1313	pF
$C_{oss}$	Output Capacitance		---	108	151	
$C_{rss}$	Reverse Transfer Capacitance		---	96	134	

### Diode Characteristics

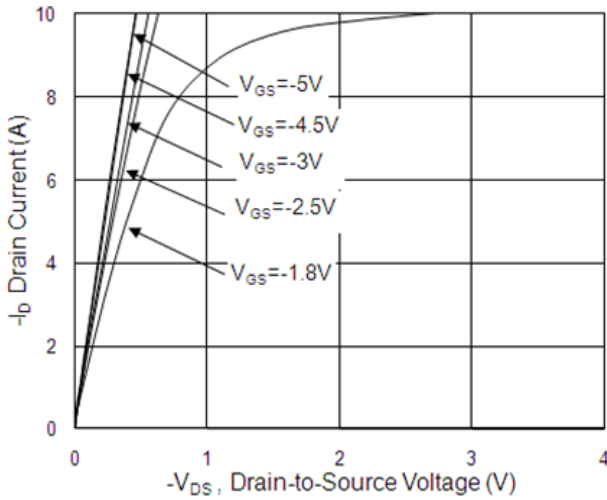
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current <sup>1,4</sup>	$V_G=V_D=0V, \text{Force Current}$	---	---	-2	A
$I_{SM}$	Pulsed Source Current <sup>2,4</sup>		---	---	-8	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=-1A, T_J=25$	---	---	-1	V
$t_{rr}$	Reverse Recovery Time	$I_F=-2A, di/dt=100A/\mu s, T_J=25$	---	34.7	---	nS
$Q_{rr}$	Reverse Recovery Charge		---	13	---	nC

Note :

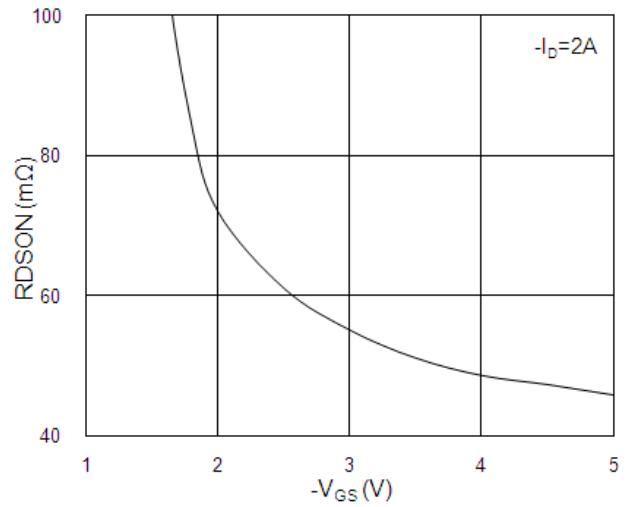
- The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
- The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
- The power dissipation is limited by 150 junction temperature
- The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

**Typical Characteristics**

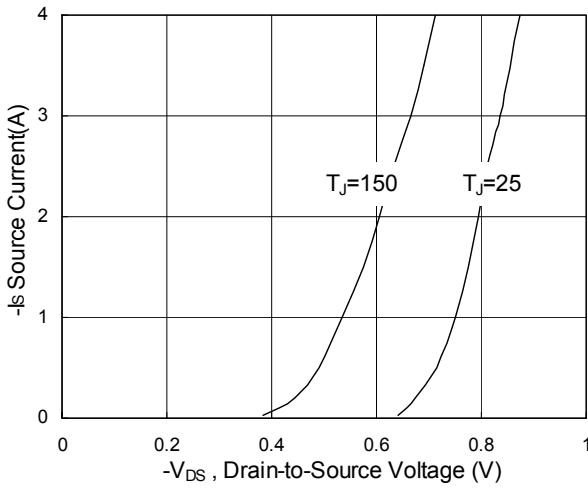
**P-Ch 20V Fast Switching MOSFETs**



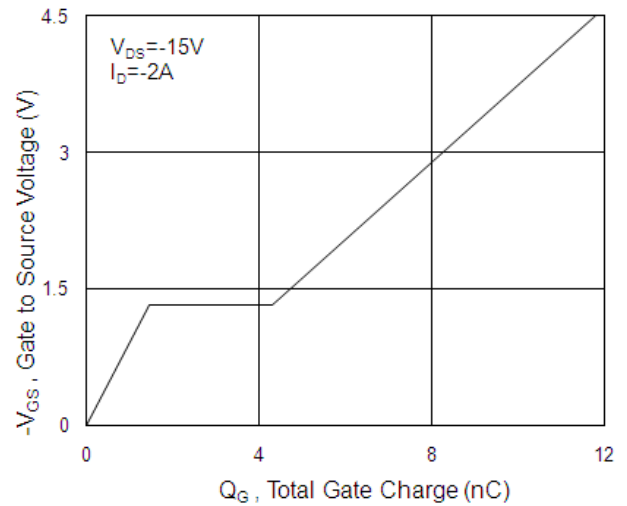
**Fig.1 Typical Output Characteristics**



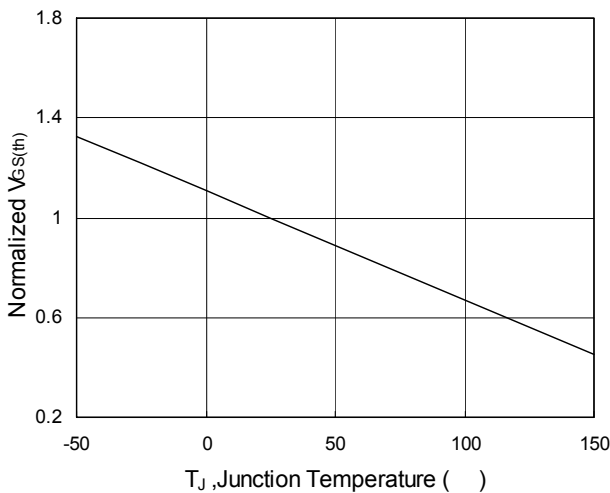
**Fig.2 On-Resistance vs. G-S Voltage**



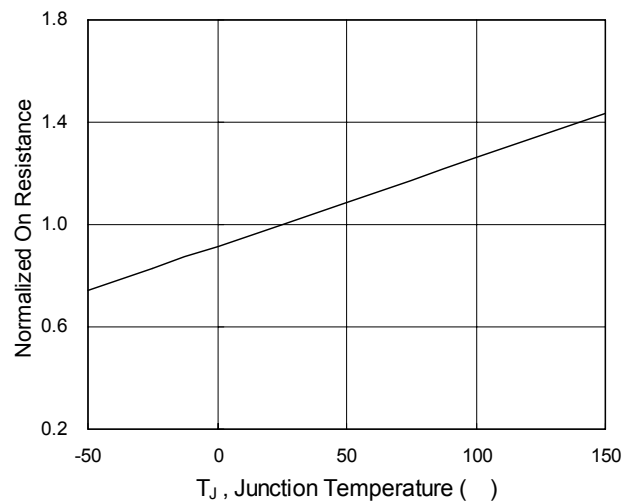
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**

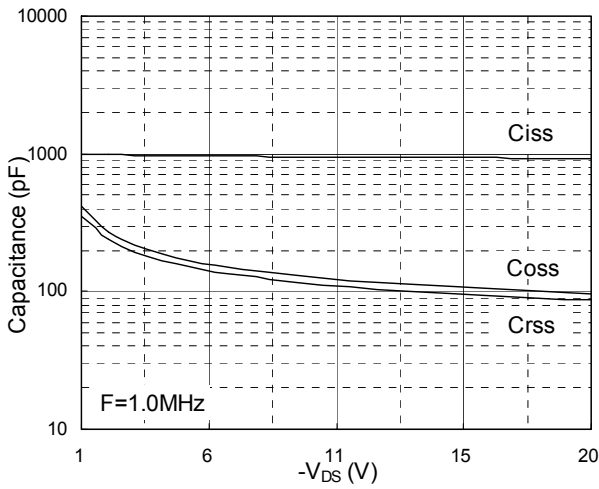


**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**

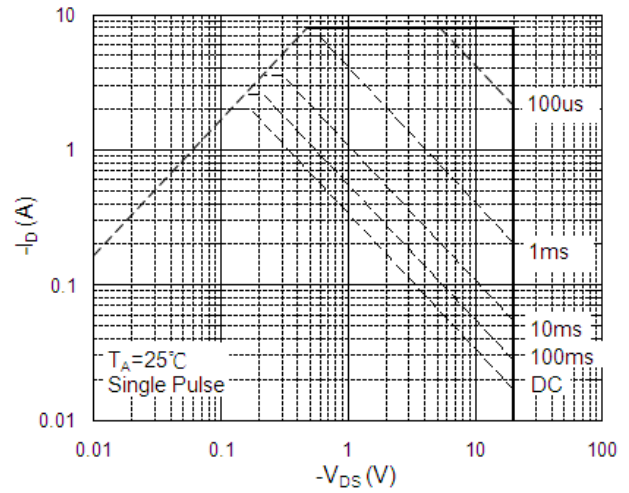


**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

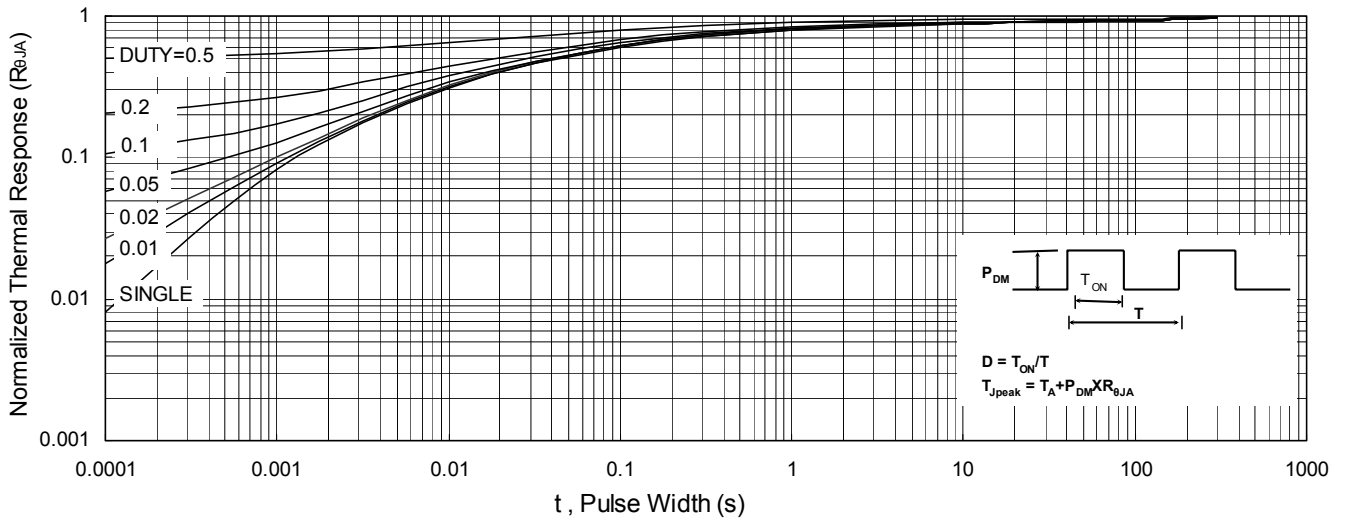
**P-Ch 20V Fast Switching MOSFETs**



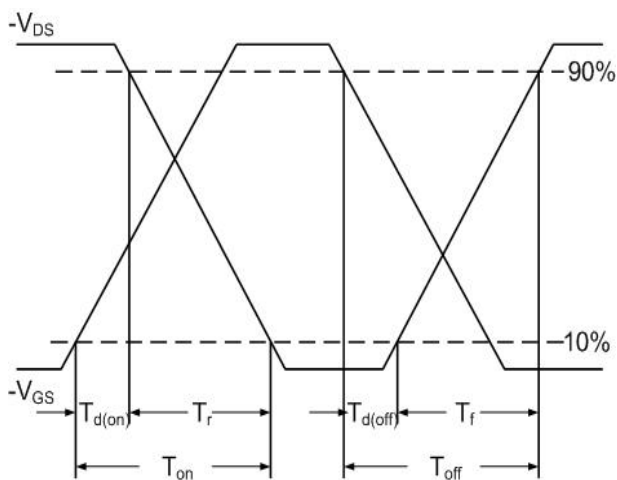
**Fig.7 Capacitance**



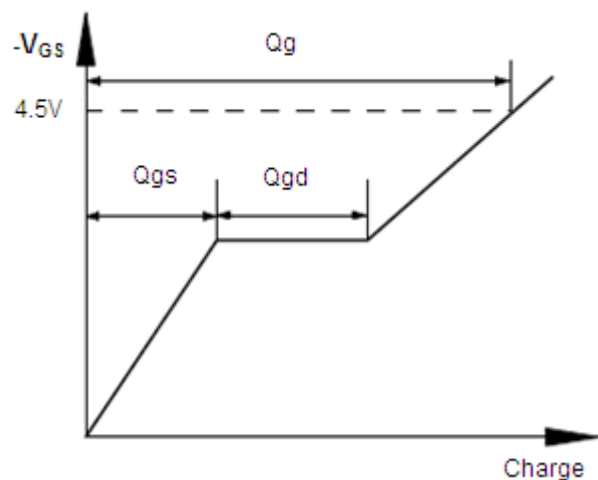
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**

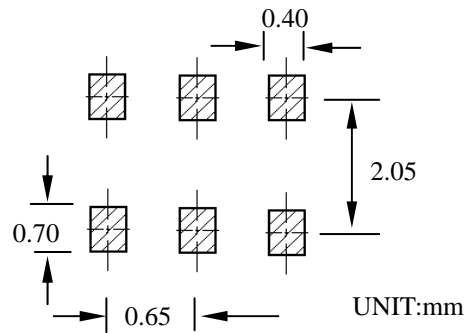
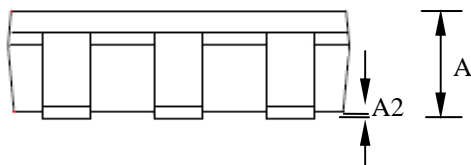
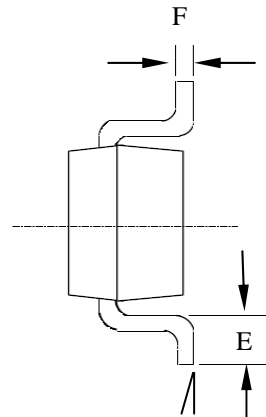
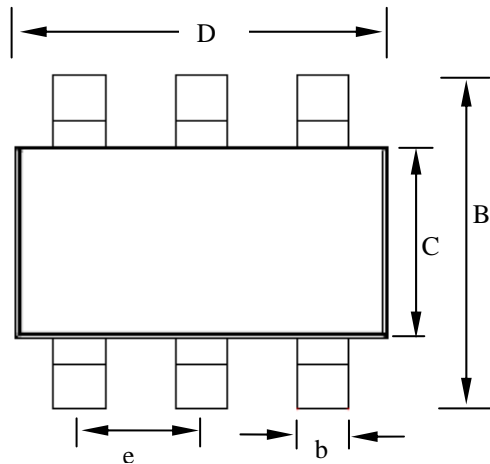


**Fig.10 Switching Time Waveform**



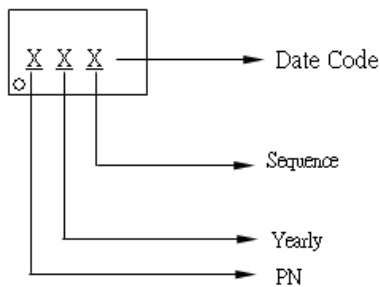
**Fig.11 Gate Charge Waveform**

**P-Ch 20V Fast Switching MOSFETs**



LAND PATTERN RECOMMENDATION

**MARKING**

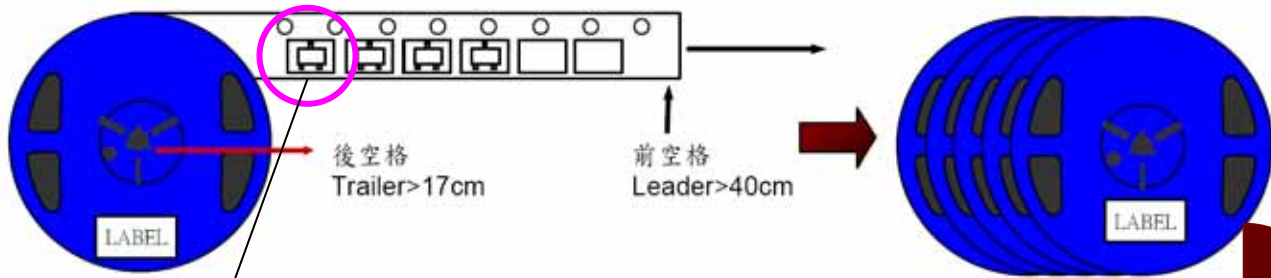


SYMBOLS	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	--	1.10	0.031	--	0.043
A2	0.00	--	0.10	0.000	--	0.004
B	1.80	2.20	2.60	0.071	0.087	0.102
C	1.15	1.25	1.40	0.045	0.049	0.055
D	1.80	2.00	2.30	0.071	0.079	0.091
E	0.15	0.36	0.46	0.006	0.014	0.018
F	0.08	--	0.25	0.003	--	0.010
b	0.15	--	0.35	0.006	--	0.014
e	--	0.65	--	--	0.026	--
θ	0°	--	8°	0°	--	8°

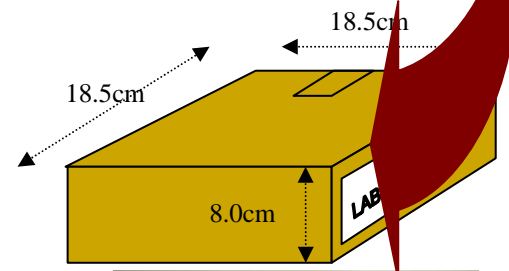
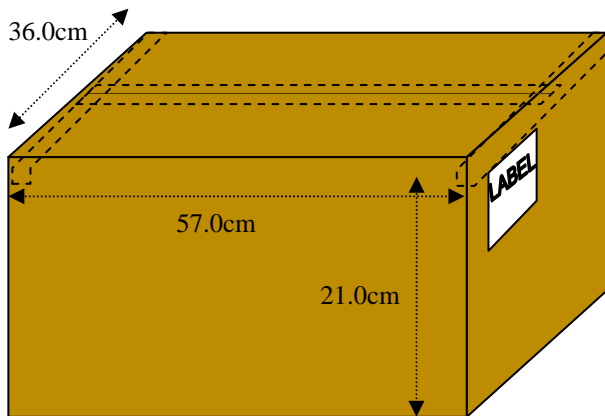
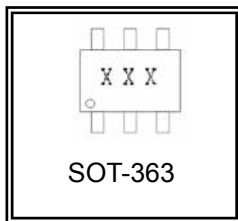
**Note:**

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
2. CONTROLLING DIMENSION IS MILLIMETER CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACTLY.

Tape & Reel 繞卷及裝箱方式 - SOT-363



產品正印及方向 - (正印為正時, Tape 圓孔在上方)



封裝形態 PKG TYPE	一般包裝		
	一卷數量 Immediate Quantity	中箱數量 Intermediate Quantity	外箱裝置/數量 Carton Quantity
SOT-363	3000pcs	15000pcs	180 K
	Reel ( 7" )	Box(5 reels)	Carton(12 Box)